PHYTOPATHOLOGY

VOLUME VIII, 1918

PHYTOPATHOLOGY

OFFICIAL ORGAN OF THE AMERICAN PHYTOPATHOLOGICAL SOCIETY

EDITORS

E. C. Stakman W. A. Orton G. P. Clinton

ASSOCIATE EDITORS

C. W. Edgerton
H. T. Güssow
N. J. Giddings
V. B. Stewart
H. P. Barss
H. A Edson
G. M. Reed
J. B. Rorer
J. T. Barrett
F. D. Fromme
W. J. Morse
I. E. Melhus

BUSINESS MANAGER

C. L. Shear

VOLUME VIII

JANUARY-DECEMBER, 1918

With 19 Plates, and 81 Text Figures

Published for the Society
Williams & Wilkins Company
Baltimore, Md.

CONTENTS OF VOLUME VIII

No. 1. JANUARY

Thomas Jonathan Burrill (1839–1916). J. T. BARRETT 1
A study of wilt resistance in the seed bed. C. W. EDGERTON 5
Some Verticillium diseases. I. C. JAGGER AND V. B. STEWART 15
Briefer articles—Experiments for the control of black spot and powdery mildew of roses. L. M. MASSEY 20
A Macrophoma disease of figs. FREDERICK WOLF AND E. E. STANFORD 24
Orange rust of Rubus in Canada. P. E. STONE 27
Influence of moisture and temperature upon infection by *Spongospora subterranea*. G. B. RAMSEY 29
Phytopathological notes 32
Literature on plant diseases 39

No. 2. FEBRUARY

Notes upon a market disease of limes. O. T. WILSON 45
The mosaic disease of Phytolacca decandra. H. A. ALLARD 51
Notes on the overwintering of forest-tree rusts. JAMES R. WEIR AND ERNEST E. HUBERT 55
Reviews 60
Phytopathological notes 62
Abstracts of papers presented at the Ninth Annual Meeting of the American Phytopathological Society, Pittsburgh, December 28, 1917, to January 1, 1918 68
Literature on plant diseases 82

No. 3. MARCH

Some of the broader phytopathological problems in their relation to foreign seed and plant introduction. BEVERLY T. GALLOWAY 87
The Alternaria leaf-spot of cotton. R. C. FAULWETTER 98
Differences between the species of Tilletia on wheat. ALDEN A. POTTER AND G. W. COONS 106
Notes on forest-tree rusts. JAMES R. WEIR AND ERNEST E. HUBERT 114
Field studies of *Cercospora beticola*. M. B. MCKAY AND VENUS W. POOL 119
Phytopathological notes 137
Literature on plant diseases 138

No. 4. APRIL

The occurrence of *Puccinia graminis tritici-compacti* in the southern United States. E. C. STAKMAN AND G. R. HOERNER 141
Determination of the factors inducing leaf roll of potatoes, particularly in northern climates. First progress report. PAUL A. MURPHY AND E. J. WORTLEY 150

334898

Contents

Pathological aspects of the Federal fruit and vegetable inspection service. C. L. Shear 155
Briefer articles:
Perennial mycelium of *Gymnosporangium blasdaleanum*. J. S. Boyce 161
Cultures of *Aecidium tubulosum* and *A. passifloricola* H. E. Thomas 163
Some new or little-known hosts for wood-destroying fungi, II. A. S. Rhoads 164
Reviews 168
Phytopathological notes 169
Literature on plant diseases 175
Report of the Ninth Annual Meeting of the American Phytopathological Society 178
Appendix 190

No. 5. May

The life history and parasitism of *Eocronartium muscicola*. Harry M. Fitzpatrick 197
The relation of phytopathologists to plant disease survey work. G. R. Lyman 219
Seed treatment control and overwintering of cucumber angular leaf spot. W. W. Gilbert and M. W. Gardner 229
Brown blotch of the Kieffer pear. George W. Martin 234
Copper sulphate as a disinfectant for potatoes. G. R. Bisby and A. G. Tolaas 240
Appendix 242
Phytopathological notes 247
Literature on plant diseases 250

No. 6. June

The growth of the potato scab organism at various hydrogen ion concentrations as related to the comparative freedom of acid soils from the potato scab. L. J. Gillespie 257
Lightning injury to herbaceous plants. L. R. Jones and W. W. Gilbert 270
Lightning injury to citrus trees in Florida. H. E. Stevens 283
A new disease of the Irish potato. C. W. Carpenter 286
Briefer articles:
Some factors affecting viability of the urediniospores of *Cronartium ribicola* George H. Duff 289
Notes on Peridermiums from Ohio. Roy G. Pierce 293
Public school survey for currant rust. W. A. McCubbin 294
Phytopathological notes 298
Reviews 300
Appendix 301
Literature on plant diseases 305

No. 7. July

Host relationships of the North American rusts other than Gymnosporangiums which attack conifers. Arthur S. Rhoads, George G. Hedgcock, Ellsworth Bethel, and Carl Hartley 309
The production of an Anthracnose-resistant white marrow bean. Walter H. Burkholder 353
Exclusion legislation and fruit tree production. V. B. Stewart 360

Contents

Dissemination of *Septoria lycopersici* Speg. by insects and pickers. W. H. Martin 365
Reviews 373
Phytopathological notes 374
Literature on plant diseases 376

No. 8. August

The black-leg disease of cabbage caused by *Phoma lingam* (Tode) Desmaz M. P. Henderson 379
Briefer articles:
Imbedding and staining of diseased wood. J. S. Boyce 432
A convenient heating and sterilizing outfit for a field laboratory. George L. Peltier and David C. Neal 463
Incubation period of *Cronartium ribicola* on the white pine. R. E. Stone 438
A morphological and cultural note on the organism causing Stewart's disease of sweet corn. Lucia McCulloch 440
Reviews 443
Phytopathological notes 445
Appendix 449
Literature on plant diseases 452

No. 9. September

Seed tuber treatments for potatoes. G. H. Coons 457
The fungus flora of pine seed beds. Annie E. Rathbun 469
Briefer articles:
Additional list of State and National quarantines against the white-pine blister rust. Roy G. Pierce 484
Reviews 487
Phytopathological notes 489
Appendix 501
Literature on plant diseases 505

No. 10. October

Potato leaf roll: Its diagnosis and cause. E. J. Wortley 507
Varieties of beans susceptible to mosaic. Donald Reddick and Vern B. Stewart 530
Briefer articles:
Two tomato diseases. Ernest Shaw Reynolds 535
An automatic spore trap. F. D. Fromme 542
A Sterigmatocystis smut of figs. Robert W. Hodgson 545
A storage fermentation of dasheens. Orville Turner Wilson 547
Reviews 550
Phytopathological notes 551
Literature on plant diseases 552

No. 11. November

Ramularia root rots of ginseng. C. L. Zinnsmeister 557
The origin and spread of tomato fruit rots in transit. J. Rosenbaum 572

CONTENTS

Briefer articles:
Notes on some methods and terms employed in studying the Uredinales. H. R. ROSEN 581
Phytopathological notes 584
Literature on plant diseases 586

No. 12. DECEMBER

Varietal susceptibility of beans to strains of *Colletotrichum lindemuthianum* (Sacc. and Magn.) B. and C. MORTIER F. BARRUS 589
Wood rots of peach trees caused by *Coriolus prolificans* and *C. versicolor*. JOHN A. ELLIOTT 616
The overwintering of *Cronartium ribicola* on Ribes. H. H. YORK AND PERLEY SPAULDING 617
Overwintering of the aeciospores of *Cronartium ribicola* Fisher. LOUISE DOSDALL 619
Reviews 620
Phytopathological notes 621
Literature on plant diseases 624

INDEX TO VOLUME VIII

ABE, KUMANOSUKE, Citrus canker in Japan, 443

Abies lasiocarpa, 115, 116

Abstracts of papers presented at Ninth Annual Meeting of American Phytopathological Society, 68–82

Acrostalagmus sp., 80

Actinomyces chromogenus, 257, 458

Aecidium, columnare, 332; elatinum, 330; ephedrae, 337; ? myrtilli, 329; passifloriicola, 163; ? Pirolae, 335; strobilinum, 337; tubulosum, 163

Agricultural Index, 247

Alfalfa diseases, research projects regarding, 504

Alien property, notes regarding report of, 621

ALLARD, H. A., The mosaic disease of Phytolacca decandra, 51–54

Alternaria, 104; panax, 98; solani, 69, 364, 367, 370; sp., 73; tenuis, 104

AMERICAN PHYTOPATHOLOGICAL SOCIETY, abstracts of papers presented at Ninth Annual Meeting of, 68–82; minutes of business meeting of Pacific Division of, 503; Report of Ninth Annual Meeting of, 178–182

Angular leaf spot of cucumber, 229

Annals of the Phytopathological Society of Japan, 444, 445

Anthracnose, 573, 579; new, on Euonymus japonica, 445; of bean, 451; of cucumber, 79; of onion, 451; of onion sets, 70; resistance of onions to, 70; resistant white marrow bean, 353

Aphides on mosaic-diseased plants, 54

Aplanobacter Stewarti, 440

Aposphaeria brassicae, 390, 429

Apple, bitter rot of, 3; McIntosh variety, drouth injury to, 490; nursery stock, crown gall on, 247; scald, air movement as a factor in the prevention of, 69; Septobasidium pedicellatum on, 215; soft scald of, 68

Armillaria mellea, 215

ARTHUR, J. C., proof of bacterial nature of pear blight by, 3

Aspergillus niger, 472, 481

Aster, Coleosporium solidaginis on, 57

Auriculariaceae, 197, 213

Bacillus amylovorus, on apple branches, 68; pathogenicity of for blossoms of strawberry, 33

Bacteria, cause of disease in plants, idea advanced by Burrill, 3; possible relation of to non-leguminous plants, 4

Bacterial oat blight, 489, 490

Bacterium, citri, susceptibility of Xanthoxylum clava-hercules to, 34; lachrymans, 229; malvacearum, 98, 105; Stewarti, 440; tumefaciens, 362

BAKKE, ARTHUR L., Longevity of Helminthosporium teres, 80

BALL, E. D., see HEADLEE, THOMAS J.

Barberry, eradication of, 450; Verticillium diseases of, 75; Verticillium on, 81

Barley, diseases, 450; Puccinia graminis tritici-compacti on, 142; Rhynchosporium (Marssonia) diseases of, research project regarding, 504

BARRETT, J. T. Thomas Jonathan Burrill, 1–4

BARRUS, MORTIER F., Varietal susceptibility of beans to strains of Colletotrichum lindemuthianum (Sacc. and Magn.) B. and C., 589–605

Bean, anthracnose disease of, 353; diseases, 451; Bean-pod meal for culture media, 445, 446; Wells Red Kidney, immunity of from Colletotrichum lindemuthianum, 531; white marrow, anthracnose-resistant, 353

Beans, diseases of, 503; index to varieties and species inoculated with Colletotrichum lindemuthianum, 605; rust of, 76; varietal susceptibility to strains of Colletotrichum lindemuthianum, 589; varieties of susceptible to mosaic, 530

Beet, curly-leaf disease of 168,
Berberis Thunbergii, Verticillium disease of, 15
BETHEL, ELLSWORTH, see HEDGCOCK, GEO., G., and RHOADS, ARTHUR S.
Betula, Melampsoridium betulinum on, 58
Birch, Melampsoridium betulae on, 59
BISBY, G. R., A Fusarium disease of garden peas in Minnesota (abstract), 77; and Tolaas, Copper sulphate as a disinfectant for potatoes, 240, 241; Minutes of War Emergency Conference of Great Plains Plant Pathologists, 19, 20, 301–303
Bitter rot of apples, Burrill's investigations of, 3
Blackberry, rust of, 27
Black-leg, of cabbage caused by Phoma lingam (Tode) Desmaz, 379; of cabbage, distribution of, 427; of cauliflower, 380; of potato, 450; of rape, 381
Black spot, 573, 579; of cacao, 550; of rose, 20–22
Blight, early, of potato, 450; of tomato, 69; late, of potato, 450; limb, of fig, 24; oat, bacterial, 489; of bean, 451; of spinach, 74; of walnuts, research project regarding control of, 504; Phoma, of red cedar, 33
Blister-rust disease, 35
Blossom end rot of tomato, 538
Botanical abstracts, 172–174; papers, illustrating, 186–190
Botrytis, blight of golden seal, 75; cinerea, 73, 76; parasitica, 75; sp., 24; sp. on geranium, 76
BOYCE, J. S., Perennial mycelium of Gymnosporangium blasdaleanum, 161–167; imbedding and staining of diseased wood, 432–436
BRANN, J. W., see VAUGHAN, R. E.
BROOKS, CHARLES, AND COOLEY, J. S., Air movement as a factor in the prevention of apple scald (abstract), 69; and Fisher, D. F., Soft scald of apples and cherries (abstract), 68
Brown blotch of Kieffer pear, 234; Brown rot of lemons, 45
Bubankia, crotonis, 335; mexicana, 337
Buckeye rot, 573, 580
BURKHOLDER, WALTER H., The production of an anthracnose-resistant white marrow bean, 353–359
BURRILL, THOMAS JONATHAN, biographical sketch of, 1–4
BUTLER, O., On the preservation of phytopathological specimens in their natural colors, 66–68

Cabbage, black-leg disease of caused by Phoma lingam (Tode) Desmaz, 379; diseases, 451; seed, results of inoculations of with Phoma, 394
Cacao, black spot of, 550; diseases and pests of in Ecuador (review), 550; "machete" or cutlass disease of, 550; wet rot of, 550
Caeoma, 337; abietis-canadensis, 328; artica, 328; (Uredo) azaleae, 329; betulinum, 330; bigelowii, 326; conigenum, 337; dubium, 338; medusae, 327; occidentale, 327; strobilina, 337
Calyptospora, 311, 332; columnaris, 115, 117, 332; goeppertiana, 332
Canker of fig, 24, 27
CARPENTER, C. W., A new disease of the Irish potato, 286–287
Castilleja, Peridermium filamentosum on, 73; Peridermium harknessi on, 73
Cauliflower, black-leg disease of, 380
Cedar, dry rot of, 433; incense, witches' brooms on, 161; red, Phoma blight of, 33; white, Gymnosporangium ellisii on, 161; white, Gymnosporangium myricatum on, 161
Cercospora beticola, 119; host limitations of, 120; overwintering of, 120; spread by insects and irrigation water, 132; viability of on dried beet tops fed to animals, 129; viability of on siloed beet tops, 130
Cereal, diseases, discussion of, 449; seed, effect of disinfection on germination of, 248; seed, treatment of for smuts, 502; smuts of, project for control of, 504; Fusarium saprogenesis on, 450
Chaffy spot of pear, 235
Cherry, leaf spot of, 72; soft scald of, 68
Chestnut-blight fungus, spores of on beetles, 366

Chlorosis, leaf, of tomatoes, 534
Chrysomyxa, 335; ledi, 334; ledicola, 334; pirolae, 335; weirii, 311, 335
Cionotirix (Cronartium) praelanga, 339
Citrus, canker, immunity of Satsuma orange to, 443; in Japan (review), 443; on Washington navel orange, 443; treatment of, 443; scab in Japan, 550; trees, Colletotrichum gloeosporioides attacking, 285; trees, lightning injury to, 283
Cladosporium fulvum, 69
Clavaria, muscicola, 209; muscigena, 197; uncialis, 210
Club root of cabbage, 451
Coleosporium, 311; anceps, 339; apocynaceum, 339; arnicale, 339; Begonia, 339; bletinae, 339; campanulae, 320; dahliae, 339; delicatulum, 320; elephantopodis, 311, 321; eupatorii, 339; helianthi, 311, 321; inconspicuum, 322; ipomoeae, 311, 322; laciniaria, 322; madiae, 323; mentzeliae, 339; occidentale, 339; on aster, 313; on Solidago, 313; paraphysatum, 339; pini, 326; plumierae, 339; ribicola, 311, 323 senecionis, 323; solidaginis, 57, 311, 323, 324; sonchi, 325; sonchi-arvensis, 325; steviae, 339; terebinthinaceae, 311, 325; verbesinae, 225, 292, 311, 321, 325; veroniae, 292, 311, 325; viburni, 339; viguierae, 321
Colletotrichum, gloeosporioides, on citrus trees, 285; lindemuthianum, 353; lindemuthianum, immunity of Wells Red Kidney bean from, 531; lindemuthianum on bean pods, 68; lindemuthianum, varietal susceptibility of strains of beans to, 589; phomoides, 573, 579
Comandra, Cronartium pyriforme on, 311
Comptonia peregrina, alternate host for Peridermium comptoniae, 293
Conifers, North American, rusts of, 309; rusts on, 339
COOLEY, J. S., see BROOKS, CHARLES
COONS, G. H., Seed tuber treatment for potatoes, 457–468; see POTTER, ALDEN A.; and SPRAGG, F. A., Resistance and susceptibility of certain wheat varieties to loose smut (abstract), 69
Copper sulphate as a disinfectant for potatoes, 240
Coriolus prolificans, cause of wood rot in peach trees, 616
Corn, diseases, 503; diseases, discussion of, 449; Physoderma on, 39; Physoderma zeae-maydis of, 223; rust, 449; smut, 449; smut following hail, an epidemic of, 584; survey of root rots of, 449
Corticium laetum, 24
Cotton, Alternaria leaf spot of, 98; lightning injuries of, 274; Ozonium omnivorum of, 275
Cronartium 63, 311, 315, 204; cerebrum, 74, 311, 315; cerebrum on Quercus, 59; coleosporioides, 63, 317; coleosporioides on Pedicularis groenlandica, 63; comptoniae, 310, 318; filamentosum, 310, 317; fusiforme, 316; occidentale, 311, 318; on Castilleja, 313; on Grossularia, 312; on Orthocarpus, 313; on Pedicularis, 313; on Quercus, 313; on Ribes, 312; pyriforme, 310, 319; quercus, 315; quercuum, 315; ribicola, 310, 319, 370; ribicola, factors affecting viability of urediniospores of, 289; ribicola, dispersal distance of urediniospores of as indicated by rate of fall in still air, 35; ribicola on white pine, incubation period, 438; ribicola, overwintering of aeciospores of, 619; sp.?, 317
Crown gall on apple nursery stock, 247
Cucumber, angular leaf spot, 79, 229; anthracnose of, 79; lightning injury to, 279; mosaic disease of, 74, 77; white-pickle mosaic disease of, 32
Cucurbits, mosaic disease of, 74, 77
Culture, exchange, 451; media, bean-pod meal for, 445
Cultures, "hanging drop," a new method for making, 447
Curly-leaf disease of beet, 168
Curly top of sugar beets, research project regarding, 504
Currant rust, public school survey for, 294
Currants, quarantines against, 485

Dasheens, a storage fermentation of, 547; Fusarium solani on, 54

DAVIS, J. J., Tilletia on wheat in North Dakota, 247
DEAN, GEO. A., see HEADLEE, THOMAS J.
Diaporthe batatatis, 73
Diplocarpon rosae, 22
Diplodia bataticola, 73; natalensis, 45
Disinfection, effect of on germination of cereal seed, 248
DOOLITTLE, S. P., 299; AND GILBERT, W. W., Further notes on cucumber mosaic disease (abstract), 77
DOSDALL, LOUISE, Overwintering of the aeciospores of Cronartium ribicola Fisher, 619
Drouth injury to McIntosh apple, 490
Dry rot, of cedar, 433; of gladiolus, 71
DUFF, GEORGE H., Some factors affecting viability of the urediniospores of Cronartium ribicola, 289–297
DURRELL, L. W., Factors influencing the uredospore germination of Puccinia coronata (abstract), 81
Dusting experiments, 63; for control of plant diseases, research project regarding methods and materials, 504

Early blight of tomato, 365
EDGERTON, C. W., A study of wilt resistance in the seed bed, 5–14; Bean-pod meal for culture media, 445–446; Delayed ripening of tomatoes caused by spraying with Bordeaux mixture (abstract), 69
EDSON, H. A., Murrill's and Saccardo's names of polypores, compared, by William Alphonso Murrill (review), 300
Eggplant, Verticillium diseases of, 75; Verticillium on, 81; wilt disease of, 15
Elder, Jew's-ear fungus on, 215
Elephantella groenlandica, 63
ELLIOTT, CHARLOTTE, Bacterial oat blight, 489, 490; JOHN A., Nematode injury to sweet potatoes, 169; Wood rots of peach trees caused by Coriolus prolificans and C. versicolor, 616, 617
Elm, Jew's-ear fungus on, 215
Emmer, Fusarium saprogenesis on, 450
Endothoa parasitica, 495
Eocronartium, 197; muscicola, 197; muscicola, synonomy, 212; muscigena, 212; on Hypnaceae, on Leskaceae, 199 typhuloides, 197
Epicoccum sp., 73
Erinose of leitchi, 287
Eriophyes, undescribed species of, 287
Exobasidium, Breviere, 214; vaccinii on Azalea indica, 68
Experiments for the control of black spot and powdery mildew of roses, 20–23
Extension work, 451

Fabraea maculata on quince, 64
Faulwetter, R. C., The Alternaria leaf spot of cotton, 98–105
Fermentation of dasheens, a storage, 547
Fern rusts, Hyalospora, 37
Ferns, Auriculariaceae, 216; Uredinopsis on, 217
Fig, canker, 24; limb blight of, 24
Figs, a Sterigmatocystis smut of, 545; Macrophoma disease of, 24–27
FISHER, D. F., see BROOKS, CHARLES
FITZPATRICK, HARRY M., The life history and parasitism of Eocronartium muscicola, 197–218
Foot rot of cabbage, 380; cauliflower, 380
Forage crops, diseases of, 503
Forest, pathology, war emergency problems in, 503; tree rusts, 115; tree rusts, overwintering of, 54, 59, 551
FRACKER, S. B., Effect of crown gall on apple nursery stock, 247
FROMME, F. D., An automatic spore trap, 542–544; Minutes of the War Emergency Conference of Plant Pathologists of the Central East, 242, 243; Relative susceptibility of beans to rust, 76
Fruit diseases, 451; means of control of, 503
Fruit, Federal inspection of, 155
Fungi, Auriculariaceae on, 216; found in soil at different depths, list of, 472; in plate cultures, method of making permanent mounts of entire colonies of, 446; wood-destroying, 164
Fungicidal and insecticidal dusts, new method of preparing, 503
Fungicides, 451; tests of, Federal rather than State problem, 504
Fungus flora of pine seed beds, 470

Fusarium, acuminatum, 73; batatatis, 73; caudatum, 73; cultures, comparative virulence, 11; disease of garden peas, 77; hyperoxysporum, 73; incarnatum, 73; lancea, 73; orthoceras, 73; orthoceras var. triseptatum, 73; oxysporum, 73; radicicola, 73; saprogenesis, 450; saprogenesis on cereals, 450; on emmer, 450; on grasses, 450; solani, 73; solani on dasheens, 548; sp., 76, 473; wilt of potato, 450; of tomato, 80, 451

Gallowaya, 326; pini, 326
GALLOWAY, BEVERLY T., Some of the broader phytopathological problems in their relation to foreign seed and plant introduction, 87
GARDNER, M. W., AND GILBERT, W. W., Cucumber angular leaf spot and Anthracnose overwintering and seed treatment control, 79; see GILBERT, W. W.; see JONES, L. R.
Geranium, Botrytis sp. on, 76
Gibberella saubinettii, 73
GILBERT, W. W., AND GARDNER, M. W., Seed treatment and overwintering of cucumber angular leaf spot, 229–233; see DOOLITTLE, S. P.; see GARDNER, M. W.; see JONES, L. R.
GILLESPIE, L. J., The growth of the potato scab organism at various hydrogen ion concentrations as related to the comparative freedom of acid soils from the potato scab, 257–269
Ginseng, Ramularia root rots of, 557
Gladiolus, dry rot of, 71
Gloeocystidium praetermissum, 215
Gloesporium filicinum, 214
GODFREY, G. H., Sclerotium rolfsii on wheat, 64–66
Golden seal, Botrytis blight of, 75
Gooseberries, quarantine against, 485
Grain rusts, 450
Grapevines, lightning injury of, 299
Grass seeds, rust on, 169
Grasses, Fusarium saprogenesis on, 450; puccinia graminis-tritici-compacti on, 142
GREGORY, CHAS. T., see WHETZEL, H. H.
Guepinia spathularia, 165
Guignardia aesculi on horse chestnut, 64
GÜSSOW, H. T., A new method for "hanging-drop" cultures, 447; Drouth injury to McIntosh apple (abstract), 490, 491; Microphotography simplified, 447, 448; Observations on obscure potato troubles, 491–495
Gymnoconia interstitialis, 27
Gymnosporangium blasdaleanum, 161, 433; ellisii, 161; juniperi-virginianae, 544; myricatum, 161; sp?, 161

Hail, epidemic of corn smut following, 584
"Halo blight" of oats, 489
HARTER, L. L., AND WEIMER, J. L., A surface storage rot of sweet potatoes (abstract), 73; Storage rots of sweet potatoes (abstract), 73
HARTLEY, CARL, Rhizoctonia as a needle fungus, 62; see RHOADS, ARTHUR A.
HARTMAN, R. E., see JOHNSON, JAMES
HEADLEE, THOMAS J., Report of the special committee appointed to formulate the attitude of the American Association of Official Horticultural Inspectors on the question of prohibiting the importation of nursery stock from foreign countries, 170
Heating and sterilizing outfit for a field laboratory, 436
HEDGCOCK, GEO. G., AND HUNT, N. REX, Notes on Cronartium cerebrum (abstract), 74; BETHEL E., AND HUNT, N. REX, Notes on some Western Uredineae (abstract), 73, 74; see RHOADS, ARTHUR S.
Helicobasidium mompa, 215
Helminthosporium teres, 80
HENDERSON, M. P., The black-leg disease of cabbage caused by Phoma lingam (Tode) Desmaz, 379
Herpobasidium filicinum, 214
HESLER, LEX R., see WHETZEL, H. H.
Heterodera radicicola, 491
HODSON, ROBERT W., A Sterigmatocystis smut of figs, 545, 546
HOERNER, G. R., see Stakman, E. C.
HOLWAY, E. W. D., Infected grass seeds and subsequent rust development, 169
HOPKINS, E. F., The disease of tulips caused by Botrytis parasitica (abstract), 75

HORNE, WM. T., Report of the first War Emergency Conference of the plant pathologists of the West with the Pacific Division of the American Phytopathological Society at Berkeley, California, March 30, 1918, 502–505
Horse chestnut, leaf blotch of, 64
HUBERT, ERNEST E., see WEIR, JAMES R.
HUNGERFORD, CHAS. W., Fourth Annual Conference of Cereal Pathologists, Lafayette, Indiana, June 19–21, 1918, 500
HUNT, N. REX, see HEDGCOCK, GEO. G.
Hyalopsora aspidiotus, 37; polypodii, 37
Hyalopsorae fern rusts, 37
Hymenochaete agglutinans, 165
Hyphomycetes, 71
Hypnaceae, Eocronartium on, 199

Illustrating Botanical papers, 186–190
Insecticidal and fungicidal dusts, new method of preparing, 503
Insecticides, 451
Insects, Auriculariaceae, on, 216; dissemination of Septoria lycopersici by, 365
Inspection service, Federal, 155
Irpex lacteus, 167

JAGGER, I. C., Hosts of the white-pickle mosaic disease of cucumber, 32, 33; Mosaic disease of cucurbits (abstract), 74; and STEWART, V. B., Some Verticillium diseases, 15–19; Some Verticillium diseases (abstract), 75
JEHLE, R. A., Susceptibility of Xanthoxylum clava-hercules to Bacterium citri, 34, 35
Jew's ear fungus, 215
JOHNSON, JAMES, and HARTMAN, R. E., Influence of soil temperature on Thielavia root rot (abstract), 77
JOHNSON, JAMES, Wilt disease of tobacco attributed to Fusarium, 76
Jola, 213, 217; javensis 214; lasiboli, 214; mahensis, 214
JONES, L. R., Laboratory outlines in plant pathology (review), 60, 61; and GILBERT, W. W., Lightning injury to herbaceous plants, 270–282; and GILBERT, W. W., AND GARDNER, M. W., Lightning injury to crops. Records of observations, 80

KEITT, G. W., Third progress report on investigations of leaf spot of cherries and plums in Wisconsin (abstract), 72
KEMPTON, F. E., and ANDERSON, H. W., Quince rot (abstract), 71
KERN, FRANK D., Field laboratories of the Pennsylvania Agricultural Experiment Station, 621, 622; Report alien property, 621
Kernel smut of sorghum, 71

Laboratories, field, of the Pennsylvania Agricultural Experiment Station, 621, 622
Larix, Razoumofskya laricis on, 63
Lawn grass, Sclerotium disease of, 72
Leaf, blotch of horse chestnut, 64; chlorosis of tomato, 534; disease of nursery stock, 63; mold of tomato, 69; roll of potato, 150; cause of, 517 diagnosis of, 510; losses from in Bermuda, 508; spot, Alternaria, of cotton, 98; spot, angular, of cucumber, 79, 229; spot of cherries, 72; spot of plum, 72
Leak of tomato, 573, 579
LEE, A. ATHERTON, Early occurrence of citrus scab in Japan, 551
Legislation, nursery stock exclusion, 360
Lemon, brown rot of, 45
Leptothyrinum pomi, 235
Leskeaceae, Eocronartium on, 199
Libertella, 25; ulcerata, 24
Lightning injury to citrus trees, 283; to cotton, 274; to crops, 80; to cucumbers, 279; to grapevines, 298; to herbaceous plants, 270; to potatoes, 270; to tobacco, 276; to tomatoes, 280
Limb blight of fig, 24
Lime, Jew's ear fungus on, 215
Limes, market disease of, 45–50
Litchi chinensis, 287; mite disease of, 286
Loose smut, resistance and susceptibility of wheat varieties to, 69
LYMAN, G. R., Minutes of the War Emergency Board of American Plant Pathologists, Washington Conference, 193–195; The relation of phytopathologists to plant disease survey work, 78.

McCLINTOCK, J. A., Spinach blight (abstract), 74
McCUBBIN, W. A., Dispersal distance of urediniospores of Cronartium ribicola as indicated by their rate of fall in still air, 35–36
McCULLOCH, LUCIA, A morphological and cultural note on the organism causing Stewart's disease of sweet corn, 440–441
McKAY, M. B., AND POOL, VENUS W., Field studies of Cercospora beticola, 119–136
MacMILLAN, H. G., An epidemic of corn smut following hail, 584–585
Macrophoma, 25; disease of figs, 24–27; Fici, 24, 26
Macrosporium, 104; gossypinum, 104; nigricantium, 104; solani, 573 579; sp. on mosaic-diseased pokeweed plants, 54; sydowianum, 235
Maples, wilt disease of, 80
Market disease of limes, 45
Marrow cabbage, disease of, 379
MARTIN, GEORGE W., Brown blotch of the Kieffer pear, 234–238; W. H., Dissemination of Septoria lycopersici Speg. by insects and pickers, 365–372
MASSEY, L. M., Dry rot of Gladiolus (abstract), 71–72; Experiments for the control of black spot and powdery mildew of roses, 20–23
MATZ, J., A method of making permanent mounts of entire colonies of some fungi in plate cultures, 446
Medusae, 326
MEIER, F. C., 299
Melampsora, 311. 326; abietis-canadensis, 328, 338; albertensis, 327; (Uredo) alpina, 340; arctica, 117, 328; betulae, 311, 330; betulinum, 330; bigelowii, 55, 58, 311, 326; bigelowii on willow, 311; caryophyllacearum, 330; cerastii, 330; elatina, 330; farlowii, 332; (Uredo) lini, 340; medusae, 326; occidentale, 327, 338; on Cerastium, 313; paradoxa, 326; salicis-albae, 55
Melampsorella, 311, 330; elatina, 114, 118; on Alsine, 313; on Stellaria, 313; sp? 331
Melampsoridium, 311, 330, 339; alni, 339; betulae, 330; betulinum on Betula spp., 58
Melampsoropsis, 311, 334, 339; abietina, 334; arctostaphyli, 339; cassandrae, 311, 334; chiogenis, 339; empetri, 339; ledicola, 334; piperiana, 339; pyrolae, 56, 59, 311, 335
MELCHERS, L. E., Physoderma (Zeae Maydis?) in Kansas, 38; and PARKER, JOHN H., Three varieties of hard winter wheat resistant to stem rust, 79; see POTTER, ALDEN A.
MELHUS, I. E., Seed treatment with hot solutions of formaldehyde and mercuric chlorid (abstract), 81
Melilotus alba, Phoma oleracea on, 392, 429
Micrococcus amylovorus, 3
Microphotography simplified, 447
Mildew, powdery, of the rose, 23
Mildews of Illinois, Burrill's monograph on, 3
Minutes of War Emergency Board of American Plant Pathologists, 193–195; of War Emergency Conference of pathologists of Central East, 242; of War Emergency Conference of plant pathologists of Northeast, 244; of War Emergency Conference of Great Plains plant pathologists, 301–303; of War Emergency Conference of plant pathologists of North Central East, 449–452
Mistletoe, spp., 62
Mite disease of litchi, 287; of tomato, 287
Mites, association of with new disease of Irish potato, 286
Mohortia, 217
Moniliaceae, 71
Monilia, sp., 550
Mosaic disease, mottled leaf, 75; of cucumber, 32, 74, 77; of cucurbits, 74; of Phytolacca decandra, 51–54; of potato, 450; of potato, transfer of by inarching, 485; of pumpkin, 75; of squash, 75; of tobacco, 51; white pickle; of cucumber, 32; varieties of beans susceptible to, 530

Moss, Auriculariaceae on, 216; Clavaria muscicola on, 209; Eocronartium on, 197; Jola on, 213
Mucor botryoides, 472; heterogamus, 472; racemosus, 73; sp., 73, 472
MUNN, M. T., Pathogenicity of Bacillus amylovorus (Burr.) Trev. for blossoms of the strawberry, 33
MURPHY, PAUL A., AND WORTLEY, E. J., Determination of the factors inducing leaf roll of potatoes, particularly in Northern climates, first progress report, 150–154
Mustard, family, host range of Phoma lingam in, 405; seedlings, results of inoculations of with Phoma from pure culture, 394
Mycogene (?), 473
Mycological laboratory, establishment of at Durban, South Africa, 38

Nail-head spot, 573, 579
Natal herbarium, 38
Navel orange, Washington, citrus canker on, 444
NEAL, DAVID C., see PELTIER, GEORGE L., 436
Necium, 332; farlowii, 311, 332
Neck rot of onion, 451; of onion sets, 70
Nectria ipomoeae, 73
Nematode galls on cucumber, 68; on sweet potato, 169
Nursery stock, domestic production of, 360; exclusion legislation, 360; introduced hosts for important parasites, 360; leaf diseases of, 63
Nut crops, diseases of, 503

Oat, blight, bacterial, 489; diseases, 450
Oats, "halo blight" of, 489
OBERLY, EUNICE R. (compiler,) AND SMITH, FLORENCE P., Literature on plant diseases, 39–41, 82–86, 138–140, 175–177, 250–255, 304–307, 376–378, 452–456, 505–506, 552–555, 586–587, 624–627
Onion, anthracnose of, 70; diseases, 451, 503; sets, neck rot of, 70
Oospora, 481; scabies, 70
Orange rust, aecial hosts, 28; telial hosts, 28
Ordonia, 217; orthobasidion, 217
ORTON, W. A., Organization and correlation of research and extension work in plant pathology (abstract), 78
OSMUN, A. VINCENT, Minutes of the War Emergency Conference of Plant Pathologists of the Northeast, 244–246; and KROUT, W. S., A new sclerotium disease of lawn grasses, 72
Ozonium omnivorum, 275

Pacific division of American Phytopathological Society, minutes of business meeting of, 503
Papaipema nitela, 275
Parasitism of Eocronartium musicola, 198–218
PARKER, JOHN H., see MELCHERS, LEO E.
Peach trees, decayed, Schizophyllum commune on, 616; wood roots of caused by Coriolus prolificans and C. versicolor, 616
Pear, blight, proof of bacterial nature of by J. C. ARTHUR, 3; Thomas Jonathan Burrill original investigator of, 2; chaffy spot of, 235; Kieffer, brown blotch of, 234; Septobasidium pendicellatum on, 215
Peas, Fusarium disease of, 77; wilt disease of, 77
Pedicularis groenlandica, 63
PELTIER, GEORGE L., AND NEAL, DAVID C., A convenient heating and sterilizing outfit for a field laboratory, 436–438
Penicillia, 472
Penicillium, sp., 73
Peniophora pubera, 215
Peridermium, 335; abietinum, 334; acicolum, 313, 320, 324; and related forms, index to uredinial and telial hosts of, 344; and related species, index to pycnial and aecial hosts of, 340; balsameum, 333; Betheli, 319; boreale, 115, 331; californicum 323; carneum, 293, 321, 325; cerebrum, 74, 313, 315, 337; coloradense, 114, 313; columnare, 115, 332; comptoniae, 292, 318; conorumpiceae, 335; consimile, 334; delicatulum, 320; elatinum, 313, 331; engelmanni, 335; ephedrae, 312, 337; filamentosum,

313, 317; fischer, 325; fragile, 322; fructigenum, 328; fusiforme, 74, 313, 316; giganteum, 315; globosum, 315; gracile, 336; guatemalense, 336; harknessi, 73; helianthi, 321; holwayi, 116, 336; inconspicuum, 322; ingenuum, 336; intermedium, 325; ipomoeae, 322; larcis, 330; mexicanum, 315; minutum, 335; montanum, 313, 324; oblongisporium, 323; occidentale, 312, 318; ornamentale, 115, 336; peckii, 329; pini minor, 337; pseudo-balsameum, 333; pustulatum, 329; pyriforme, 73, 319; ribicola, 323; rostrupi, 320; stalactiforme, 317; strobi, 312, 319; terebinthinaceae, 325
Peridermiums, 310; from Ohio, 292
Personals, 68, 137–138, 174, 298–299, 375, 448–449, 499–500, 551, 585, 622–623
Phoma, 25; blight of red cedar, 33; brassicae, 380; destructiva, 573, 579; lingam, cause of black-leg diseases of cabbage, 379-341; napobrassicae on rutabaga roots, 392, 429; oleracea, 381, 389, 429; rot on tomato, 573; siliquastrum, 389, 429; tests of pathogenicity of, 393
Physolospora cydoniae, 71
Physoderma in Kansas, 38; zeae-maydis on corn, 223
Phytopathological notes, 445–449, 489–500; problems, in their relation to foreign seed and plant introduction, 87–97; Society of America, abstracts of papers presented at Ninth annual meeting of, 68–82; Society of Japan, annals of, 444; specimens, preservation of in natural colors, 66
Phytopathologist, desired in Brazil, 585
Phytopathologists, relation of to plant disease survey work, 78, 219–228
Phytopathology, outline of history of, 487; report of the Chief Editor of, 182–186
Phytophthora, cactorum, 563; Faberi, 550; infestans on potatoes, 68; terrestria, 573, 579
Phytoptosis, a mite disease of the tomato, 287
Picnoporus cinnabarinus on decayed peach trees, 616
PIERCE, ROY C., Additional list of State and National Quarantines against the white pine blister rust, 484–486; Notes on Peridermiums from Ohio, 292–297
Pine, Cronartium ribicola on, 310; seed beds, fungus flora of, 470; white, blister rust, danger to West from, 503; white, incubation period of Cronartium ribicola on, 438
Pines, Cronartium cerebrum on, 74; Peridermium filamentosum on, 73; Peridermium pyriforme on, 73, 77; rust of, 292
Pinus, Razoumofskya larcicis on, 62; spp., rusts of, 292
Pistillaria, 209
Plant, diseases, literature on, 39–43, 82–86, 138–140, 175–177, 250–255, 304–307, 376–378, 452–456, 505–506, 552–555, 586–587, 624; disease survey, 452; disease survey work, 78
Plant, pathology, 78; in Japan, 445; in the Union of South Africa, 38; laboratory outlines in, 60; pathologists, deferred draft classification for, 374; pathologists, need of trained, 452; physiology, Palladin's (review), 373; quarantine, 360; quarantine legislation, 170–172
Plasmodiophora brassicae on cauliflower, 68
Platygloea hymenolepidis, 214; Peniophorae, 215
Plenodomus destruens, 73
Pleurotus serotinus, 165
Plowrightia morbosa on cherry, 68
Plum, blotch, 74; leaf spot of, 72
Pokeweed, mosaic disease of, 51
Polyporus, dichrous, 165; gilvus, 167; hirsutus, 166; obtusus, 166; pargamenus, 166; versicolor, 166
Pomegranate, Sterigmatocystis rot of, 546
POOL, VENUS W., see MCKAY, M. B.
Potato, Canadian, Verticillium on, 181; diseases, 450; diseases, importance of emergency work on, 503; late-blight resistant strain of, 445; leaf roll, cause of, 517; diagnosis of, 510; losses from in Bermuda, 508; on, 150; lightning injury to, 80, 270; mite, 286; mosaic disease of transferred by inarching, 495; pow-

dery scab of, 29; Rhizoctonia on, 240; Rhizoctonia disease of, 457; scab, 70, 81, 457; scab, literature, 268; scab organism, growth of at various hydrogen ion concentrations, 257; seed treatment, 70, 450; stalk borer, 275; troubles, obscure, 491; Verticillium albo-atrum on, 81; Verticillium and Fusarium diseases of, research project regarding, 504; verticillium disease of, 75
Potatoes, copper sulphate as disinfectant for, 240; seed treatment for, 457
POTTER, ALDEN A., Agricultural Index, 247–248; The effect of disinfection on the germination of cereal seed, 248, 249; and COONS, G. H., Differences between the species of Tilletia on wheat, 106–113; and COONS, G. H., The species of Tilletia on wheat (abstract), 72; and MELCHERS, LEO E., Persistance of sorghum types to covered kernel smut (abstract), 71
Powdery, mildew, of rose, 23; scab of potato, 29
Projects, cooperative research and leaders of, 504
Pseudomonas citri, 443; stewarti, 440
Puccinia, 216; beckmanniae, 169; clematidis, 583; coronata, 81, 450; dispersa, 450; glumarum, 583; graminis, 141, 450; graminis tritici, 143; graminis tritici compacti, 77, 142; impatientis, 169; montanensis, 583; myrtilli, 330; Scleriae, 164; scleriicola, 164; simplex, 450
Pucciniastrum, 311, 328, 339; abietichamaenerii, 328; agrimoniae, 339; arcticum, 339; epilobii, 57, 59, 328; galii, 339; goodyerae, 339; hydrangeae, 339; minimum, 329; myrtilli, 329; padi, 337; potentillae, 339; pustulatum, 57, 117, 311, 328; pyrolae, 57, 59, 339; sparsum, 336, 339; vacciniorum, 329
Puccinium minimum, 329
Pumpkin, mosaic disease of, 75
Pure culture bureau, 451
Pyrolae, rusts of, 56
Pyrolas, Melampsoropsis pyrolae on, 59; Pucciniastrum pyrolae on, 59
Pythiacystis citrophthora, 45; congesta, 74; solitaria, 74
Quarantine, plant, 360; against white pine blister rust, 484
Quince, Fabraea maculata on, 64; rot, 71

RAMSEY, G. B., Influence of moisture and temperature upon infection by Spongospora subterranea, 29–31
Ramularia, destructens, 562, 566, 570; panacicola, 562, 566, 570; root rots of ginseng, 557
RANKIN, W. HOWARD, see WHETZEL, H. H.
Rape, black-leg disease of, 381
Raspberry, red rust of, 27
RATHBUN, ANNIE E., The fungous flora of pine seed beds, 470–483
Razoumofskya, americana, 62; douglasii, 62; laricis, 62
REDDICK, DONALD, Lightning injury to grapevines, 298; Palladin's Plant Physiology (review), 373; Report of the Chief Editor of Phytopathology, 182–186; and STEWART, VERN B., 530–534
REYNOLDS, ERNEST SHAW, Two tomato diseases, 535–542
Rhizoctonia, 503; as a needle fungus, 62; microsclerotia, 24, 446; of potato, 240, 450; research project regarding, 504; solani, 446; sp., 573, 580
Rhizopus, nigricans, 73, 475, 482; sp., 573–580
RHOADS, ARTHUR S., Some new or little-known hosts for wood-destroying fungi, 164–167; HEDGCOCK, GEORGE G., BETHEL, ELLSWORTH, AND HARTLEY, CARL, Relationships of North American rusts other than Gymnosporangiums which attack conifers, 309–352
Rhynchosporium (Marssonia) diseases of barley, research project regarding, 504
Ribes, Cronartium occidentale on, 311; grossularia, quarantines against, 485; hibernation of spores of Cronartium ribicola on, 290; overwintering of Cronartium ribicola on, 617
ROBERTS, JOHN W., Plum blotch (abstract), 74

Root, rot, Thielavia, 77; rots of corn, survey of, 449; rots of ginseng, Ramularia, 557
ROREB, J. B., Enfermedades y plagas del cacao en Ecuador y metodes modernos apropiados al cultivo del cacao (review), 550
Rose, black spot of, 20
ROSEN, H. R., Notes on some methods and terms employed in studying the Uredinales, 581
ROSENBAUM, J., The origin and spread of tomato fruit rots in transit, 572–580
Rot, blossom end, of tomato, 538; of quince, 71; surface storage of sweet potatoes, 73
Rots, of timber, research project regarding, 504; tomato fruit, origin and spread of in transit, 572
Rubus, orange rust of, 27–29
RUMBOLD, CAROLINE, Laboratory notes on cultures of Endothia parasitica, A. and A. Notes on the color reactions of reproductive and vegetative hyphae of E. parasitica when treated with chemicals, 495–499
Rust, currant, 294; of beans, 76; of blackberry, 27; of corn, 449; of ginseng root, 557; of red raspberry, 27; of sweet fern, 293; of wheat, 354; on Austrian pine, 292; on barley, 142; on grass seeds, 169; orange, of Rubus 27; stem, of wheat, 79, 142; white pine blister, danger to West from, 503; white pine blister, quarantines against, 484
Rusts, fern, Hyalospora, 37; forest tree, overwintering of, 551; in Illinois, Burrill's Monograph on, 3; of conifers, North American, 309; of forest trees, 115; of grain, 450; of Pinus, 292; on conifers, 339; on Pinus, 311; Porto Rican, 163; Some methods and terms employed in studying, 581–583; stem, 312
Rutabaga roots, Phoma napobrassicae on, 392
Rye diseases, 450

Saccoblastia, 217
Salsify, Verticillium disease of, 15; diseases of, 75
Satsuma orange, immunity of to citrus canker, 443
Scab, of potato, 70, 81, 450, 457; of wheat, 450; powdery, of potato, 29
Scald, appleair, movement as a factor in prevention of, 69
Scale insects, Septobasidium on, 215
Schizophyllum commune, 165; on decayed peach trees, 616
Sclerotinia libertiana, 563
Sclerotium, 72; bataticola, 73; disease of lawn grass, 72; rolfsii, 573–580; rolfsii on wheat, 64; tulifarum, 75
Seed, bed, wilt resistance in, 5; beds, pine, fungus flora of, 470; treatment of, 81, 450; treatment for smut of cereals, 502; treatment of grain, 450; tuber treatment for potatoes, 457
Seedlings, infected with Phoma lingam, transmittal of disease by, 430; inoculation of with Phoma lingam, 397
Seeds, how Phoma lingam is carried over in, 430; infected with Phoma lingam, treatment of, 430; inoculated with Phoma lingam, 400
Septobasidium, 217; on scale insects, 216; pedicellatum, 215; lycopersici, 365–372
Septoria blight of tomato, 451; mirabilis, 333
SHEAR, C. L., Pathological aspects of the Federal fruit and vegetable inspection service, 155–160; Report of the Ninth Annual Meeting of the American Phytopathological Society, 178–182
SMITH, FLORENCE P., see OBERLY, EUNICE R.; LOREN B., Insect transmission of spinach blight (abstract), 74; Ralph E., The beet leaf hopper and the curly leaf disease that it transmits (review), 168
Smut, cereal, explosions of, 502; cereal, removal of by suction fans, 502; corn, epidemic of following hail, 584; kernel, of sorghum, 71; loose, of wheat, 69; of barley, Japanese article on, 445; of cereals, 502; of corn, 449; of figs, a Sterigmatocystis, 545; of onion, 451
Smuts of cereals, 502; control measures for, 502; project for control of, 504

Soft scald, of apples, 68; of cherries, 68
Soil fungi, dissemination of, 479; fungi, grubs and earth-worms carriers of, 480; investigations in connection with fungus flora, 470; rot, 573, 579, 589
Solanaceae spp., Verticillium on, 18
Solanum, spp., Verticillium diseases of, 75; tuberosum, scab of, 257
Sooty blotch fungus, 235
Sorghum, kernel smut of, 71
Soy bean cake substitute for peptone in preparations of nutrient media, Japanese article on, 445
SPAULDING, PERDEY, The overwintering of Cronartium ribicola on Ribes, 617–619
Specimen exchange, 451
Sphacelotheca sorghi, 71
Sphaeria lingam, 388, 428
Sphaeronema, fimbriatum, 73; sp., 550
Sphaeropsis malorum, 71
Sphenospora pallida, 582
Spicaria (silvatica), 475–482; sp. 473, 482
Spinach blight, 74
Spongospora subterranea, influence of moisture and temperature upon infection by, 29
Spore trap, automatic, 542
SPRAGG, F. A., see COONS, G. H.
Spray materials, commercial data on value of, 451
Squash, mosaic disease of, 75
STAKMAN, E. C., AND HOERNER, G. R., Puccinia graminis tritici-compacti in southern United States, 77; The occurrence of Puccinia graminis tritici-compacti in the southern United States, 141–149
STANFORD, E. E., see WOLF, FREDERICK A.
Stem rust of wheat, 79
Stereum rameale, 167; sp. 165
Sterigmatocystis, rot of pomegranates, 546; smut of figs, 545
Sterilizing and heating outfit for a field laboratory, 436
STEVENS, F. L., Concerning a tubercular structure at the base of certain Hyphomycetes (abstract), 71; H. E., Lightning injury to citrus trees in Florida, 283–285
STEWART, F. C., The Phoma blight of red cedar, 33; V. B., Dusting experiments, in 1917, 63–64; V. B. Exclusion legislation and fruit tree production, 360–364; V. B., see JAGGER, I. C.
Stewart's disease of sweet corn, organism causing, 440
Stinking smut, 106
STONE, R. E., Incubation period of Cronartium ribicola on the white pine, 438–440; Orange rust of Rubus in Canada, 27–29.
Storage, diseases, coöperative inspection work on, 451; rots, surface, of sweet potato, 73
Strawberry, pathogenicity of Bacillus amylovorus for blossoms of, 33
Sugar beet, Cercospora beticola on, 119; seed, disinfection, 122; leaf spot, crop rotation for, 132; diseases of, 503; research project regarding curly top of, 504
Sweet, corn, organism causing Stewart's disease of, 440; fern, rust of, 293; potato, nematode on, 169; potato, surface-storage rot of, 73

Thekospora areolata, 337
Thielavia, basicola, 559; root rot, 77
THOMAS, H. E., Cultures of Aecidium tubulosum and A. passifloriicola, 163–164
Tilletia, caries, 106; laevis, 72, 106, 247; laevis on wheat, 72, 106, 247; tritici, 72, 106, 247
Timebr rots and inspection, research problem regarding, 504
Tobacco, lightning injury of, 276; mosaic disease of, 51; Thielavia root rot of, 77; wilt disease of, 76
TOLAAS, A. G., see BISBY, G. R.
Tomato, anthracnose on, 573; black spot on, 573; blossom end rot of, 538; Buckeye rot on, 573; diseases, 451, 535; early blight of, 69, 365; effect of wrapping fruit of on spread of disease in, 573; fruit rots, origin and spread of in transit, 572; Fusarium wilt of, 80; leaf chlorosis, 534; leaf mold of, 69; lightning injury of, 280; nail-head spot on,

573; Phoma rot on, 573; ripening of delayed by spraying with Bordeaux mixture, 69; soil rot on, 573; white rot on, 573; wilt fungus, 10; wilt resistance, 8
Transportation diseases, coöperative inspection work on, 451
TRELEASE, WILLIAM. Winter botany, (review), 620
Trichoderma koningi, 472
Triticum, compactum, 106; varieties, Puccinia graminis tritici-compacti on, 143
Truck crop diseases, 450, 503
Tuberculariaceae, 71; fici, 24
Tulips, disease of caused by Botrytis parasitica, 75
Typhula musicola, 197

Uredinales, 216; some methods and terms used in studying, 582; terminology of, 582; western, 73
Uredinopsis, 216, 311, 333; americana, 333; atkinsonii, 333; copelandi, 333; mirabilis, 333; on ferns, 217; osmundae, 333; phegopteridis, 333; pteridos, 333; struthiopteridis, 333
Uredo, bigelowii, 326; cassandrae, 334; (Caeoma) confluens, 340; holwayi, 338; ledicola, 334; minima, 329; pustulata, 328; quercus, 315
Uromyces, 216; appendiculatus, 76; scleriae, 164
Ustilago, tritici, 69; zeae, 584

VAUGHAN, R. E., AND BRANN, J. W., Potato seed treatment, 70
Vegetables, Federal inspection of, 155
Venturia, inaequalis on green apples, 68 pyrina on green pears, 68
Verticillium, 80; albo-atrum, 81; and Fusarium diseases of potato, research project regarding, 504; diseases, 15–19, 75; diseases of barberry, 75; diseases of eggplant, 75 81; diseases of potato, 75; 81

WALKER, J. C., Control of neck rot and anthracnose of onion (abstract), 70; Notes on resistance of onions to anthracnose, 70
Walnut blight control, research project regarding, 504
War Emergency, Board of American plant pathologists, minutes of Washington conference of, 193–195; conference of central east pathologists, 242; conference of plant pathologists of Northeast, 244; conference of plant pathologists of north central east, 449; conference of southern plant pathologists, 190–193
WEIMER, J. L., see HARTER, L. L.
WEIR, JAMES R., New hosts for Razoumofskya laricis, 62–63; and HUBERT, ERNEST E., A note on Hyalosporae, 37–38; and HUBERT, ERNEST E., Cronartium coleosporioides on Pedicularis groenlandica, 63; and HUBERT, ERNEST E., Notes on the overwintering of forest-tree rusts, 55–59; and HUBERT, ERNEST, Notes on forest-tree rusts, 114–118
Wet rot of cacao, 550
Wheat, loose smut of, 69; puccinia graminis tritici-compacti on, 142; rust of, 354; scab, 450; Sclerotium rolfsii on, 64; smut of, Japanese article on, 445; stem rust of, 107; Tilletia on, 72, 106, 247
WHETZEL, H. H., An outline of the history of Phytopathology (review), 487–488; The Botrytis blight of golden seal (abstract), 75; HESLER, LEX R., GREGORY, CHAS. T., AND RANKIN, W. HOWARD, Laboratory outlines in plant pathology, 60–61
White-pine blister rust, 290; danger to west from, 503; quarantines against, 484
White rot, 573
Willow, Melampsoropsis bigelowii on, 59, 311
WILSON, O. T., Notes upon a market disease of limes, 45–50; a storage fermentation of dasheens, 547–549
Wilt, disease of garden peas, 77; disease of maples, 80; disease of eggplant, 15; Fusarium, of tomato, 80; of tobacco, 76; resistance in the seed bed, 5–14
Winter botany, by William Trelease (review), 620

Witches' brooms, 114; on incense cedar, 161

WOLF, FREDERICK A., AND STANFORD, E. E., A Macrophoma disease of figs, 24–27

Wood-destroying fungi, 164

Wood, diseased, imbedding and staining of, 433; rots of peach trees caused by Coriolus prolificans and C. versicolor, 616

WORTLEY, E. J., Potato leaf roll: Its diagnosis and cause, 508–529; see MURPHY, PAUL A.

Yeast, 474

Yellows of cabbage, 451

Zeae maydis, 38

ZIMM, L. A., A wilt disease of maples, 80

ZINSSMEISTER, C. L., Ramularia root rots of ginseng, 557–571

Zygorrhynchus vuillemini, 472

JAN 14 1918

VOLUME 8 NUMBER 1

JANUARY 1918

Phytopathology

Official Organ of the

American Phytopathological Society

CONTENTS

Thomas Jonathan Burrill (1839–1916) ..... J. T. Rankin 1
A study of wilt resistance in the seed-bed ..... C. W. Edgerton 3
Some Verticillium diseases ..... J. C. Jagger and V. B. Stewart 13
Briefer articles—Experiments for the control of blackspot and powdery mildew of roses ..... L. M. Massey 20
A Macrophoma disease of figs ..... Frederick A. Wolf and E. E. Stanford 24
Orange rust of Rubus in Canada ..... R. E. Stone 27
Influence of moisture and temperature upon infection by Spongospora subterranea ..... G. E. Ramsey 29
Phytopathological Notes 36
Literature on plant diseases 39

PUBLISHED MONTHLY FOR THE SOCIETY

OFFICE OF PUBLICATION

2419-21 Greenmount Ave., Baltimore, Md.

Entered as second-class matter May 10, 1912, at the post office at Baltimore, Maryland, under the Act of March 3, 1879

"ORCHARD BRAND" SPRAY MATERIALS

STANDARD OF QUALITY—MAXIMUM OF EFFICIENCY

B T S*
LIME SULPHUR SOLUTION
ARSENATE OF LEAD—Dry or Paste
ARSENITE OF ZINC—Dry
ATOMIC SULPHUR
BORDEAUX MIXTURE
BORDEAUX LEAD
BORDEAUX ZINC
ARSENATE OF LIME—Powder

*B T S is a dry Barium Sulphur Compound substitute for Lime Sulphur Solution

MANUFACTURED BY

GENERAL CHEMICAL COMPANY

25 BROAD STREET, N. Y.

FACTORIES

Baltimore, Md. Syracuse, N. Y. St. Louis, Mo.

Address all correspondence to 25 Broad Street, New York City

PHYTOPATHOLOGY,

The Official Organ of the American Phytopathological Society

Issued Monthly

The Journal Treats of Diseases to Which Plants Are Subject and the Remedies for Such Diseases

SUBSCRIPTION PRICE: $5.00 (United States)
$5.50 Elsewhere

Remit to Williams & Wilkins Company, Baltimore, or
C. L. Shear, Department of Agriculture, Washington, D. C.

AMERICAN PHYTOPATHOLOGICAL SOCIETY

OFFICERS

1918

President, F. M. FREEMAN,
University Farm, St. Paul, Minn.

Vice-President, C. W. EDGERTON,
Experiment Station, Baton Rouge, La.

Secretary-Treasurer, C. L. SHEAR,
Pathologist, Bureau of Plant Industry, Washington, D. C.

ADDITIONAL MEMBERS OF THE COUNCIL

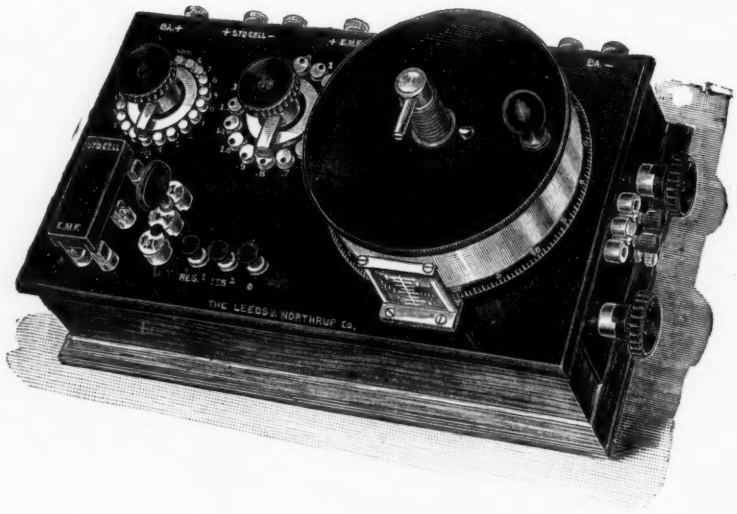
L. R. JONES,
Professor of Plant Pathology, University of Wisconsin, Madison, Wis.

H. S. JACKSON,
Chief in Botany, Purdue University Agricultural Experiment Station, Lafayette, Ind.

MEL T. COOK (*ex officio*),
Plant Pathologist, Rutgers College and New Jersey Agricultural Experiment Station, New Brunswick, N. J.

W. A. ORTON (*ex officio*),
Bureau of Plant Industry, Washington, D. C.

A POTENTIOMETER FOR THE DETERMINATION OF HYDROGEN ION CONCENTRATION IN SOLUTIONS



THE POTENTIOMETER illustrated above is now being used by a number of investigators for measuring the E. M. F. between the Hydrogen and Calomel electrodes in Hydrogen Ion Concentration determinations. It is rapidly replacing the electrometer for such work for the following reasons: first, it is much more sensitive than the electrometer; second, its use does not entail the annoying delays met with in the use of the electrometer when overcharged and thus polarized.

The Leeds and Northrup Potentiometer has two ranges. Normally measurements may be made up to 1.6 volts by steps of .00001 volt. A range changing plug enables measurements to be made up to .16 volt by steps of .000001 volt.

The precision of adjustment is such that on the high range measurements from .1 volt up may be made to a precision of better than 1/50%. On the low range measurements from .01 volt up may be made to the same degree of precision.

The instrument and its accessories require little or no attention. Its manipulation is simple.

A full description of this potentiometer will be sent upon request, as well as a list of some of those who are now using it for Hydrogen Ion Concentration determinations.

THE LEEDS & NORTHRUP CO.

ELECTRICAL MEASURING INSTRUMENTS

4930 STENTON AVENUE **PHILADELPHIA**

PHYTOPATHOLOGY

THE OFFICIAL ORGAN OF

THE AMERICAN PHYTOPATHOLOGICAL SOCIETY

EDITORS

W. A. ORTON
U. S. Department of Agriculture
Washington, D. C.

E. C. STAKMAN
University Farm
Saint Paul, Minn.

G. P. CLINTON
Agricultural Experiment Station
New Haven, Conn.

ASSOCIATE EDITORS

C. W. EDGERTON, Baton Rouge, La. H. T. GÜSSOW, Central Experimental Farm, Ottawa, Canada. N. J. GIDDINGS, Morgantown, W. Va. V. B. STEWART, Cornell University, Ithaca, N. Y.	One year
H. P. BARSS, Oregon Agricultural College, Corvallis, Ore. H. A. EDSON, U. S. Department of Agriculture, Washington, D. C. G. M. REED, University of Missouri, Columbia, Mo. J. B. RORER, Board of Agriculture, Port of Spain, Trinidad.	Two years
J. T. BARRETT, Riverside, Calif. F. D. FROMME, Blacksburg, Va. W. J. MORSE, Orono, Maine. I. E. MELHUS, Ames, Iowa.	Three years

BUSINESS MANAGER

C. L. SHEAR, U. S. Department of Agriculture, Washington, D. C.

EDITORIAL NOTICES

Manuscript for Publication or correspondence relative thereto may be addressed to W. A. Orton or to any other member of the Editorial Board. Contributors are requested, so far as convenient, to carry on preliminary correspondence and submit copy of manuscript to the nearest Associate Editor. For instance, correspondence from Canada may be addressed to H. T. Güssow, from the Pacific coast to H. P. Barss or J. T. Barrett, from the Tropics to J. B. Rorer and so forth.

Manuscripts should be typewritten and carefully revised before submission. While no attempt will be made at exact uniformity in capitalization, punctuation, spelling, citations, footnotes, etc., each contributor is requested to give careful attention to clearness and preciseness in these matters and to conform as far as practicable to the best usage in this journal.

Phytopathological Notes. Manuscript for this department should be sent to H. A. Edson, U. S. Dept. of Agriculture, Washington, D. C.

Reviews. Publications for review should be sent to H. A. Edson, U. S. Dept. of Agriculture, Washington, D. C.

Illustrations. A limited number of illustrations will be accepted. Only the very best photographs can be reproduced satisfactorily by the processes available to the journal. Authors desiring special types of reproduction may be asked to bear part of the expense. Line drawings reproduce very satisfactorily on regular text paper and usually should be submitted for use as text figures rather than as plates. Attention is called to the reproduction of photographs as text figures on a coated paper. For such purposes photographs should be submitted untrimmed and unmounted. Semi-matt printing paper is often preferable to the glossy paper.

BUSINESS NOTICES

Subscription price. $5.00 per year for all points within the United States; foreign subscriptions, $5.25; current single numbers 50 cents. The journal will be issued monthly beginning with Vol. VIII, January, 1918.

Requests to supply lost copies of the journal must be made within 40 days from date of issue. Date of issue January 1 and monthly thereafter.

Separates. No gratis copies are supplied. A printed schedule of prices is submitted with the proof and authors may secure separates by placing an order with the publishers when proof is returned.

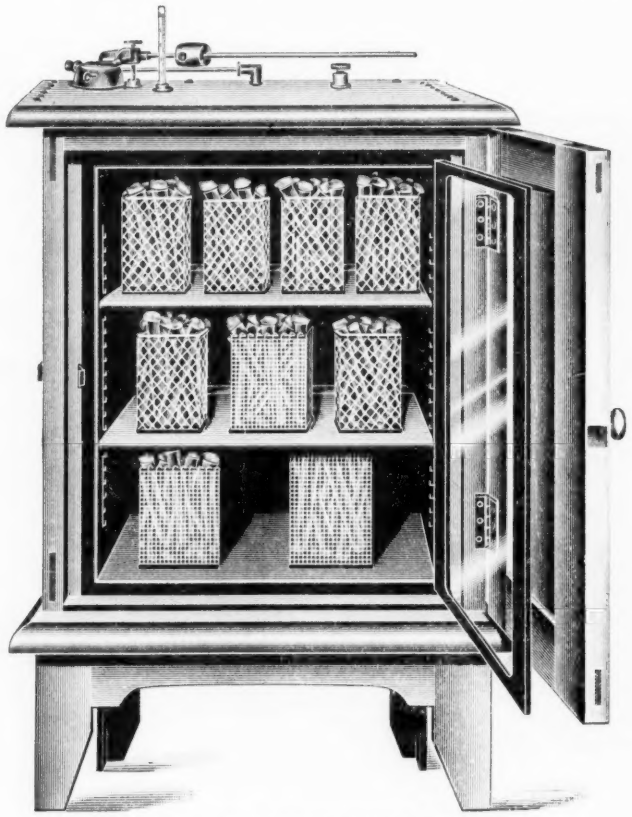
Back Volumes may be obtained unbound at $5.00 per volume, postage paid.

Separate copies will not be sold except in cases where the volumes are already broken. The price of such copies is 85 cents each.

Make all remittances payable to Phytopathology. Address all business correspondence to The Williams & Wilkins Co., 2419–21 Greenmount Ave., Baltimore, or to C. L. Shear, U. S. Department of Agriculture, Washington, D. C.

HEARSON INCUBATORS

WITH HEARSON PATENT CAPSULE TEMPERATURE CONTROL FOR GAS, OIL AND ELECTRIC HEATING



No. 20740. Hearson Gas Heating Incubator

We have supplied nearly three hundred Hearson Incubators to important U. S., State, City and Hospital bacteriological laboratories throughout the U. S. Their performance has been universally satisfactory and in view of this experience we are willing to recommend the Hearson patent capsule temperature control as being the most accurate and simple device for the uniform control of incubator temperature now on the market.

We supply them in nine sizes for gas heating, six sizes for oil heating, six sizes for electric heating, and eight sizes for low temperatures, and keep a stock on hand of the more popular sizes for immediate delivery.

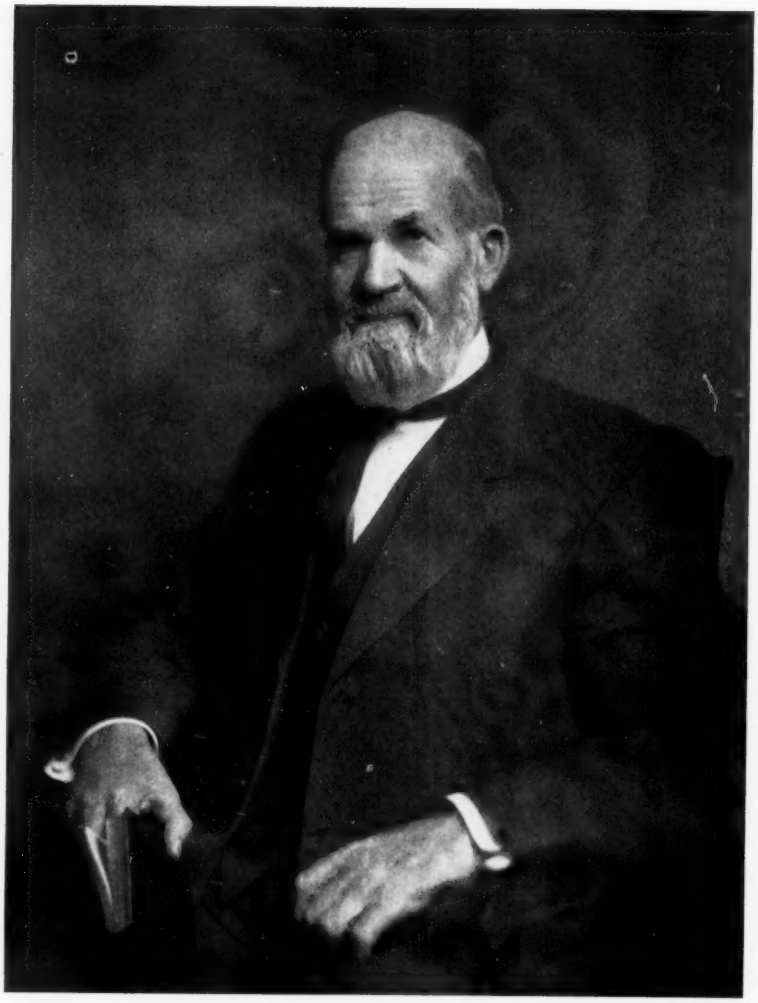
Complete descriptive pamphlet sent upon request

ARTHUR H. THOMAS COMPANY

IMPORTERS—DEALERS—EXPORTERS

LABORATORY APPARATUS AND REAGENTS

WEST WASHINGTON SQUARE PHILADELPHIA, U. S. A.



THOMAS JONATHAN BURRILL

PHYTOPATHOLOGY

VOLUME VIII NUMBER 1

JANUARY 1918

THOMAS JONATHAN BURRILL

(1839–1916)

J. T. Barrett

With Portrait, Plate I

Representative of the American pioneer spirit of the time and as a contemporary of men in Europe more thoroughly and specifically trained, perhaps, for similar lines of endeavor, the subject of this brief sketch is of special and peculiar interest to American Phytopathologists.

Thomas Jonathan Burrill was born April 25, 1839, in Pittsfield, Massachusetts. His family, influenced by the tide of westward emigration going on at the time, moved to northern Illinois and settled on a farm in Stephenson County, when Thomas was nine years of age. Here he aided his father, attending country school a few months each winter. He taught in both private and district schools, earning money which aided him to continue his studies in the Rockford high school, which he entered at the age of twenty. Having finished his preparation, he entered the State Normal University in Normal, in 1862, at the age of twenty-three, graduating from the same institution in 1865.

It was here that Burrill came in contact with some of the best teaching talent of the state as the State Normal University at that time was at the head of the state educational system.

His teacher of botany was Dr. J. A. Sewall, Curator of the Museum of the State Natural History Society, located in Normal. The annual meetings of this society held nearby in Bloomington, offered a further stimulus to his love for natural history.

During the period from 1865 to 1868, Burrill held the position of Superintendent of the Urbana public schools, devoting much of his spare time to studying the flora of the vicinity. In the summer of 1867 a rare opportunity came to him, in that he was selected as botanist to accompany Maj. John W. Powell on his expedition to explore the Grand Canyon of the Colorado and surrounding regions.

In the spring of 1868, he was called to the Illinois Industrial University in Urbana, to teach algebra. At the end of three months he was made Assistant Professor of natural history and botany. Two years later, 1870, he was advanced to the professorship of botany and horticulture, thus becoming established for a life of active and influential service on the faculty of what came to be the University of Illinois.

"He taught most of the days," says one of his friends, "was horticulturist to the experiment station, planted with his own hands or saw to the planting of most of the trees on the campus, after he had laid it out for treatment, wrote reports, lectured here and there, served on innumerable committees, collected specimens up and down the state, and, lest some remnant of his time should be unoccupied, was charged by the Board with the sale of mules, whose labors on the south farm showed that they were not so able to stand the strenuous life as he was. His professorship began at sun-up and lasted indefinitely, and included everything that needed doing."

Having the spirit of the enthusiastic pioneer, he very early set out to acquaint himself with the natural history of his state. In 1869, assisted by six students, he collected a large number of natural history specimens on a trip extending through the state from Chicago to Cairo. Of the numerous specimens collected and brought back for preservation and study, 582 were plants.

In 1875 he made a collection of the woods of the state for the Centennial Exposition. Few men have developed the intense love for trees that characterized Burrill. He was frequently heard to say, "Were I a heathen, not knowing the true God, I would not worship the sun, as did the Peruvians, nor the stars, as did the nations of the East, but would bow in adoration to the trees and herbs of the field."

Burrill's real contributions to science, largely in the field of phytopathology began to appear in 1878, ten years after his appointment to the University. His training for the work at hand, so far as classroom instruction was concerned, was indeed meagre. But being a keen observer, a patient, thorough and sympathetic worker, he succeeded where many would have given up in despair. The ravages of pear-blight had been the cause of much speculation and wild hypotheses for many years. Burrill became interested in the disease and in 1878 presented to the state horticultural society a paper reporting his preliminary studies on this malady. He described the organisms seen in the tissues as minute oscillating particles, evidently not recognizing them as bacteria. One year later he reported his success in transmitting the disease by transferring to bark of healthy trees, the exudation so abundantly produced on the diseased plants. While this result was all but convincing, Burrill fully recognized

the incompleteness of his proof as may be seen from his own words. "Does it not seem plausible that they cause the subsequently apparent change? It does to me, but this is the extent of my own faith; we should not say the conclusion is reached and the cause of the difficulty definitely ascertained. So far as I know the idea is a new one—that bacteria cause disease in plants—though abundantly proved in the case of animals."

Further and more extensive experimentation carried on in 1880, produced results which more firmly convinced him that his former conclusion was correct. The bacterial organism concerned was described in the 1882 report of the Illinois Industrial University and in the American Naturalist for 1883, as *Micrococcus amylovorus*.

While American botanists generally accepted Burrill's announcement and findings with confidence, his contemporaries in Europe looked upon the work with doubt. To J. C. Arthur, then of Geneva, it was left to furnish the connecting link of proof as to the bacterial nature of the disease. This he accomplished in 1885.

Further work on bacterial diseases of plants, carried on by Professor Burrill, included studies in 1886 and 1887 on a disease of sorghum and broom corn. Likewise a little later he described a bacterial disease of corn.

While botanist of the natural history survey, 1885 to 1891, Burrill became actively interested in taxonomic work. It was planned to publish a volume on the Cryptogamic flora of Illinois, but the need of Burrill's executive ability in the position of acting president, prevented the completion of the work. However, the two monographs published, one on the rusts, the other on the mildews of Illinois, were received as worthy additions to mycological literature.

During the summer of 1902 and the five years following he carried on, with the aid of assistants, extended investigations on the bitter-rot of apples, then so destructive in southern Illinois. The complete results of these studies were published in 1907. Other problems upon which he was engaged from time to time were ear-rots of corn, potato scab, rust of blackberry, and raspberry, and peach "yellows."

Professor Burrill was a true friend to agriculture and greatly aided the Illinois College of Agriculture to attain the magnificent position of influence it now holds. In 1876, he was granted the degree of A.M. by the Northwestern University and in 1893, the honorary degree of LL.D. by the same institution. The University of Chicago conferred the honorary degree of Ph.D. upon him in 1881. In June 1912, just previous to his formal retirement, the University of Illinois set its seal of approval upon his immeasurable services by conferring upon him the honorary degree of LL.D.

Burrill received many honors from the various scientific societies of which he was a member. He was president of the Society of American Bacteriologists at the time of his death.

After his retirement in September, 1912, he soon became engaged in active research on a problem that had been of great interest to him for many years. This question of whether the relationship that exists between the nodule bacteria and the leguminous plants may not be developed between the bacteria and non-legumes, lay uppermost in his mind, and work upon it was prosecuted to the end with the vigor of his earlier years.

The life of Professor Burrill covered a wide range of activities, teacher, investigator, executive, counselor and friend. He served in all with wisdom and ability. He was generous, often to the detriment of his own department, sympathetic yet firm; and his sincere religious nature appealed to all.

As an ideal companion he was resourceful and interesting in conversation, always capable of seeing the amusing side of a situation yet never given to the nonsensical.

The close association with him which it was the writer's privilege to enjoy for several years as student and assistant, will ever remain a pleasure and source of inspiration.

And here I repeat the fitting words of his close friend and long time colleague, Professor S. A. Forbes: "He loved people better than things, education better than science, and others better than himself. We owe him honor not only for what he did, but even for what he might have done if he had been a man of less generous mold."

GRADUATE SCHOOL OF TROPICAL AGRICULTURE
AND CITRUS EXPERIMENT STATION
RIVERSIDE, CALIFORNIA

A STUDY OF WILT RESISTANCE IN THE SEED-BED

C. W. Edgerton

With Four Figures in the Text

In disease control work, the use of resistant varieties is becoming more and more important and the probabilities are that in the future, the development of such varieties will become one of the most important problems of the practical plant pathologist and plant breeder. That disease resistant varieties can be produced has been demonstrated in a number of instances, some important examples being plants affected with root or wilt diseases caused by members of the genus Fusarium. Wilt-resistant cottons have been known for a number of years and varieties of cabbages and tomatoes resistant to the wilt diseases are now being developed.

In the past the usual method of obtaining wilt-resistant varieties has been to grow the plants in a field known to be infested with the wilt disease and then select healthy plants for seed. This method has many serious disadvantages among which are the following.

1. In order to obtain satisfactory results by this method, too great an acreage is required for the experiments. When one can only expect an occasional plant out of a large number to show any degree of resistance, it is necessary to have a very large number of individual plants. It is often difficult to obtain a considerable acreage of ground with a heavy infestation of the organism and it is not often that suitable facilities are present for carrying on such an extended project.

2. By this method of selection, seed from many plants are saved that have no wilt-resistant qualities. A plant may show no signs of the disease even in a badly infested field and yet not be resistant to the disease. Even in such a field, many plants will have none of the fungus present in the soil immediately surrounding the roots and consequently will have no chance to become infected. On account of this factor it is necessary to save seed from a great many plants, and in order to test these a large acreage is required the succeeding year.

3. With this method of selection, susceptible plants grow close to the desired resistant ones and the chances are that the latter will be fertilized with pollen from susceptible plants. If this occurs, it means considerable more time to have the factor of disease resistance fixed.

4. Unless one is very fortunate in the very beginning in obtaining some plant that is very resistant, it usually takes too long a period of time to produce a great amount of disease resistance. Several years, at least, is necessary to make sure that satisfactory results have been obtained. On account of the time factor alone, a great many attempts to select resistant varieties have been failures.

While making a study of the wilt of tomatoes caused by the fungus, *Fusarium lycopersici*, a method of selecting plants in the seed-bed has been used which promises to be very helpful in disease resistance work. This method has been briefly described in a previous article.[1] The soil for the seed-beds, made from good garden loam mixed with leaf mold, is first thoroughly sterilized by steam. It is then heavily contaminated with a pure culture of the wilt fungus and the seed planted. Susceptible plants growing in soil treated in this manner will take the wilt disease very rapidly and many of them will die or show signs of the infection before they are ready to be planted in the field. By selecting only healthy plants for field planting, a large percentage of the susceptible ones can be eliminated in the seed-bed.

The sterilization of the soil eliminates a large number of the bacteria and fungi which would normally tend to check the development of the wilt fungus in the soil. That a disease organism of this kind will develop much more rapidly in sterilized soil than in ordinary unsterilized soil has been recognized for some time. This fact was first brought to the attention of the writer while working on the bean anthracnose disease.[2] It has also been discussed by Hartley in his articles on damping off of coniferous seedlings. That it is also true with the wilt disease of tomatoes has been demonstrated a great many times during the past few years. Comparative tests made with heavily contaminated sterilized and unsterilized soils have always shown a considerable higher percentage of the plants dying in the sterilized soil while they were still in the seedling stage and too small to be set in the field (fig. 1). It is only necessary to give the results of two of the many experiments that have been tried. In both of these experiments, the tomato plants were grown in pots, the soil in half of them being sterilized in the autoclave under pressure while the rest was left untreated. The soil in all of the pots was heavily contaminated with pure cultures of the tomato wilt fungus and seed of a susceptible variety of tomatoes planted the same day. The young plants were examined every few days and all that had died of the wilt or showed signs of the disease were pulled and counted.

[1] Edgerton, C. W. A new method of selecting tomatoes for resistance to wilt disease. Science n. s. **42**: 914–915. 1915.

[2] Edgerton, C. W. The bean anthracnose. Louisiana Agr. Exp. Sta. Bul. 119: 37-39. 1910.

In the first experiment, the seed was planted in the pots on March 3, 1917. The total number of plants and the number dead or diseased at different periods is given in table 1.

In the other experiment the seed was planted in the pots on March 12, 1917. A different culture was used for contaminating the soil than was used in the first experiment. The total number of plants and the number dead or diseased at different periods is given in table 2.

In both of the above experiments, it is seen that the disease developed much better on plants in the sterilized soil and also at an earlier period than on those in unsterilized soil.

TABLE 1

Effect of sterilized and unsterilized soil on the development of tomato wilt in the seed-bed

TREATMENT OF SOIL	NUMBER OF PLANTS	NUMBER AFFECTED AFTER					PER CENT AFFECTED
		41 days	49 days	55 days	64 days	69 days	
Unsterilized	213	2	21	39	86	129	60.6
Sterilized	367	23	77	125	244	314	85.6

TABLE 2

Effect of sterilized and unsterilized soil on the development of tomato wilt in the seed-bed

TREATMENT OF SOIL	NUMBER OF PLANTS	NUMBER AFFECTED AFTER					PER CENT AFFECTED
		40 days	46 days	55 days	60 days	64 days	
Unsterilized	344	5	10	34	51	78	22.7
Sterilized	281	27	48	149	211	244	86.8

In the practical work in breeding tomatoes for wilt-resistance at the Louisiana Experiment Station, seed-bed selection is being combined with field selection. A small plot of ground that has grown tomatoes continuously for eight or ten years and which is known to be very badly infested with the wilt fungus is used. In this field plants are set that do not show signs of the disease in the infested seed-beds. In the seed-bed at planting time, the diseased plants can usually be told by holding them up to the light. If the wilt is present, the black bundles usually can be plainly seen through the stem. This method of selection and breeding seems superior to the old method in at least the following ways. (1) The acreage in the field is much reduced as a large percentage of the susceptible plants have been eliminated in the seed-bed. (2) The number of

plants that can be tested depends only upon the size of the seed-beds. Many more plants are grown than are set in the field. (3) The most susceptible plants are removed and there are fewer of the resistant plants fertilized with pollen from susceptible ones. (4) All of the plants are growing in infested soil in the seed-bed and no plant will escape being in contact with the infection during the growing season. (5) As a result of the above, less time will be required to obtain the resistant strains.

In selection for wilt-resistance in tomatoes, it is very difficult to do much with most of the common commercial varieties on account of their great susceptibility and fixed characters. With these it is difficult to obtain a start in the work. Some of the varieties showing extreme susceptibility under Louisiana conditions are Stone, Acme, Chalk's Early Jewel, Beauty, John Baer and a number of others. Even with varieties that show some resistance such as the Earliana, the strengthening of the resistance is not easy. Work with resistant varieties such as the Globe might be more satisfactory but unfortunately their other characters do not make them suitable for Louisiana conditions.

The work that is promising to give the best results is a combination of hybridization and selection. In 1909, a plant growing in a row of Acme was noticed that did not take the wilt while all of the rest died. It is probable that this was not an Acme plant but had come from a seed that had accidentally found its way into the Acme seed. The seed from this plant was saved and selections were made for several years. This strain, which is called "Louisiana Wilt-Resistant" in this article, was extremely resistant but it had other characters which made it undesirable under Louisiana conditions. Its propagation was finally discontinued. Crosses, however, were made between this and the Earliana and an attempt has been made to procure not only a wilt-resistant strain but one with other desirable qualities. Some of the selections from these crosses show considerable resistance and are of good quality and the work at present seems promising.

The use of reinoculated, sterilized soil is of much service in studying a disease like the tomato wilt in other ways than in its use in selecting resistant strains. Much information can be obtained readily regarding such points as the relative resistance of the different varieties of the host, the relative virulence of different strains of the pathogene, and the effect of different soils and of different substances added to the soil on the development of the wilt.

This investigation has been continued long enough to show that if a variety of tomatoes shows high susceptibility to the disease in the seed-bed, it will also show the same in the field. Some varieties like the Stone and Acme die very rapidly in the contaminated seed-bed and they also

develop the disease very badly in the field; other varieties like the Globe and the Louisiana Wilt-Resistant do not succumb so readily in the seed-bed and neither do they die so rapidly in the field. In figure 2, are shown two varieties of tomatoes growing in the same pot of infested soil. The plants in the left half of the pot are of the Acme variety while those in the right half are of the Louisiana Wilt-Resistant. Nearly all of the Acme plants are seen to be dead while most of those of the wilt-resistant variety are living and healthy.

Different strains of the tomato wilt fungus do not show the same virulence and this fact is readily determined by the seed-bed method. This

FIG. 1. EFFECT OF STERILIZATION OF SOIL PREVIOUS TO INOCULATION ON THE DEVELOPMENT OF TOMATO WILT

The soil in the pot on the right was sterilized and then contaminated with the tomato wilt fungus; the soil in the pot on the left was contaminated but not sterilized. Most of the plants in the sterilized soil died with the wilt disease.

gives a better method of studying the fungus and also enables one to determine readily whether a strain with which one is working is virulent. Saprophytic species or strains of Fusarium are frequently picked up while culturing old tomato stems and their pathogenicity can be quickly determined. In table 3 are given the results from a number of tests with different strains of Fusarium which were isolated from wilted tomato plants. The table shows the percentage of diseased plants in three different tests fifty to eighty days after the soil in the pots was contaminated and planted.

This table shows that some of the cultures, as for example no. 1707, are particularly virulent. Other cultures show less virulence while some show none or at most but very little. Some of the latter may be specifically distinct from *Fusarium Lycopersici* though they could not be separated satisfactorily by the ordinary cultural characters. This table also shows that the virulence of the fungus had not diminished to any appreciable extent after growing for a period of more than two years on culture media.

FIG. 2. COMPARISON OF SUSCEPTIBLE AND RESISTANT VARIETIES OF TOMATOES IN RECONTAMINATED STERILIZED SOIL

In the left half of the pot was planted, a susceptible variety, Acme; in the right half was planted a resistant variety, Louisiana Wilt Resistant. Most of the plants of the susceptible variety are dead.

All soils do not give equally good results in the seed-bed work. The one that has given the best results is a good garden soil mixed with a considerable proportion of leaf mold. The leaf mold undoubtedly furnishes the organic matter for the rapid development of the fungus. The percentage of infection obtained in an experiment using pots of different soils is given in table 4.

This method of growing young plants also seems to be of considerable value in determining the effect of various substances added to the soil on the development of the wilt disease. The effect of various fertilizers, disinfectants, lime, and so forth, on the development of the wilt can probably be determined readily thus saving the time and expense of extended field experiments. The same proportion of the substance to be tested can be applied to the soil in the seed-bed as would be applied in the field.

TABLE 3

Comparative virulence of cultures of Fusarium

CULTURE NUMBER	PERCENTAGE OF PLANTS DISEASED		
	January, 1915 Acme	October, 1915 Prosperity	December, 1916 Chalk's Early Jewel
Check	0	0	0
1699	100.0	41.4	54.2
1701	0	1.1	
1702	0	1.0	
1703	96.2	85.5	66.5
1704	0	0	
1705	0	0	
1706	97.8	16.8	49.3
1707	97.5	82.6	80.2
1709	82.3	39.1	72.9

TABLE 4

Development of wilt in seed-beds with different soils

SOIL	PERCENTAGE OF DISEASED PLANTS	
	Acme	Louisiana Wilt-Resistant
River sand	20.0	3.1
Garden soil (loess)	52.2	15.8
Impure sand	70.0	18.2
Sand and leaf mold	68.0	33.3
Soil, sand and leaf mold	84.2	42.9
Soil and leaf mold	92.9	72.2

That the seed-bed tests will give comparable results with field tests has been demonstrated by some experiments with lime. Some preliminary experiments having shown that very heavy applications of lime would retard the development of the wilt disease in the seed-bed, a series of experiments was started using lime both in the seed-bed and in the field. Lime was applied at the rate of five and ten tons per acre. The percentage of diseased plants in the seed-beds with this heavy application of lime is given in table 5.

For the field experiments, a plot of ground badly infested with the wilt fungus was used. A part of this was treated with lime at the rate of 10 tons per acre, a part at the rate of 5 tons per acre and the rest was left untreated. The lime was slaked in piles and then worked into the upper layers of the soil as well as possible. Tomato plants were set in all three plots. On June 2, the number of diseased plants of two varieties in each plot was counted. The percentage of diseased plants on that date and the total yield in pounds for a row containing fifty-five plants for the whole season is given in table 6.

As seen by the table, the results obtained in the field with lime are in accordance with those obtained in the seed-bed experiments. The heavy

TABLE 5

Effects of lime on the development of wilt in seed-beds

TREATMENT OF SOIL	PERCENTAGE OF DISEASED PLANTS
Check, untreated	51.0
Lime, 5 tons per acre	21.7
Lime, 10 tons per acre	4.4

TABLE 6

Effect of lime on tomato wilt in the field

TREATMENT OF SOIL	PERCENTAGE OF DISEASED PLANTS		YIELD IN POUNDS	
	Acme	Earliana	Acme	Earliana
Check, no lime	77.4	75.5	7.9	88.7
Lime, 5 tons per acre	78.6	46.4	18.6	102.5
Lime, 10 tons per acre	40.4	23.1	21.5	134.7

application of lime decreased the wilt and the plants produced a larger yield of tomatoes. In figure 3 are shown susceptible varieties growing on untreated badly infested soil, while in figure 4 are shown the same varieties in soil that had been treated with lime at the rate of 10 tons per acre. The good effects of the lime can be plainly seen. The photographs were taken at the time when the two plots showed the greatest contrast. As the season advanced, most of the plants in the treated plot also died with the disease. No claim is made that lime treatment would be of value in controlling the disease as the cost of treatment would probably more than offset the gains obtained. The experiment is only given to show the value of the seed-bed studies in their relation to field conditions.

Only a very few seed-bed experiments have been tried with other wilt-producing species of Fusarium. A few tests have been made with *Fu-*

FIGS. 3 AND 4. EFFECT OF LIME ON THE DEVELOPMENT OF TOMATO WILT IN THE FIELD

Above, plants in badly infested soil not treated with lime; below, plants in badly infested soil that had been treated with lime at the rate of 10 tons to the acre.

sarium conglutinans Wr. the fungus causing cabbage yellows, and with *Fusarium vasinfectum*, the fungus causing cotton wilt, but these have not been extended enough to give any reliable information. In the tests with *Fusarium conglutinans*, the cabbage plants took the disease very readily in the reinoculated soil. With the cotton wilt, however, only about 2 or 3 per cent showed the characteristic blackening of the fibro-vascular bundles.

SUMMARY

1. Certain wilt diseases of plants produced by species of Fusarium can be studied in the seed-bed to better advantage than in the open field. If the soil in the seed-bed is sterilized and then heavily contaminated with a pure culture of the wilt fungus just before planting the seeds, the young plants that develop will take the disease very rapidly.

2. By growing plants under such conditions, selections for wilt resistance can be made in the seed-bed and much of the work and many of the difficulties of field selection can be eliminated.

3. Data regarding varietal resistance to disease, virulence of various cultures of the wilt fungi, and the effect of different soils and different substances in the soil on the development of the disease organisms can be obtained by growing the plants in reinoculated, sterilized soil.

LOUISIANA AGRICULTURAL EXPERIMENT STATION
BATON ROUGE, LOUISIANA

SOME VERTICILLIUM DISEASES

I. C. Jagger and V. B. Stewart

According to Carpenter[1] Verticillium diseases have been reported on potato, okra, eggplant, snapdragon, dahlia, Abutilon, and Xanthium. Rankin[2] has reported a similar disease on maple.

For several years a very destructive wilt disease of eggplant (*Solanum melongena* Linn.) has been under observation in the vicinity of Rochester, New York. Affected plants make a stunted growth and the lower leaves gradually turn yellow, wilt, and drop off. Some plants die prematurely. Diseased crops are commercial failures and the growing of eggplants is being gradually discontinued in this region on account of the rapid spread of the disease. Newly infected plants show a light brown discoloration of the wood of the roots and bases of the stems. Plants that have been diseased for some time show a dark brown discoloration of the wood of all parts of the plant and of the fibro-vascular bundles of the fruits. A species of Verticillium has been repeatedly isolated from the wood of all parts of diseased plants and from the fibro-vascular bundles of fruits. The fungus apparently over-winters in the soil and gains entrance to the plants through the roots.

A Verticillium disease of *Berberis Thunbergii* DC. attracted attention in 1916 in the same vicinity, where several nursery and ornamental plantings were found to be severely diseased. Affected plants show a yellowish or reddish discoloration of the foliage. Frequently only portions of the plant are diseased and the discolored foliage on the affected branches is sharply contrasted with the green leaves of healthy shoots. The sapwood of affected shoots and roots is markedly streaked with dark reddish brown lines running with the fiber. Ultimately all the wood appears brownish green to black. Plants of all ages are attacked. The progress of the disease is not especially rapid and diseased plants may not be killed entirely for several seasons after infection. Repeated isolations have yielded each time a species of Verticillium. Fungous hyphae are abundant in the vessels.

During the summer of 1917 a Verticillium disease was very noticeable on salsify (*Tragopogon porrifolius* Linn.) in the same locality. The outer

[1] Carpenter, C. W. The Verticill'um wilt problem. Phytopath. **4**: 393. 1914.
[2] Rankin, W. H. Thrombotic disease of maple. Phytopath. **4**: 395. 1914.

leaves gradually wilt and die until only a few of the youngest leaves remain alive. The region of the xylem of roots and rootlets shows a grayish brown discoloration. On microscopical examination the discoloration is found to be confined primarily to the vessels which contain an abundance of mycelium. A species of Verticillium has been isolated.

STUDIES OF VERTICILLIUM CULTURES

Cultures of Verticillium from potato,[3] eggplant, maple,[4] and barberry were transferred to the following media in test tubes: potato agar, nutrient agar and oat agar. There were three strains of each fungus isolated from potato, barberry, and eggplant, and one strain from maple. The cultures were made July 4, 1917 and on July 13, all had made practically the same amount of growth, the mycelium covering most of the agar surface in the tubes. The colonies of fungi from eggplant and barberry were indistinguishable and became black rapidly, the discoloration extending to within about 1 cm. of the growing edge of the colony. The discoloration was confined to the surface region which was covered and surrounded by a thin white aerial growth of mycelium. The black discoloration of cultures from maple and potato developed much less rapidly.

The same cultures were examined again at the end of three months. The cultures from eggplant, barberry and maple were indistinguishable. The entire surface was a uniform black color on potato and oat agar and more or less isolated black specks were embedded in the medium to a depth of 3 to 4 mm. On nutrient agar the discoloration was confined to the central portion of the colony. All cultures showed a thin weft of aerial mycelium. The cultures from potato were markedly different from those from other hosts. There were a few irregular black areas scattered over the surface of the potato and oat agar media and black strands extended from the surface area into the medium to a depth of 3 to 4 mm. Cultures of the fungus from potato showed no discoloration on nutrient agar.

Microscopical examination showed that the discoloration in cultures from eggplant, barberry and maple resulted from the presence of many definite, more or less spherical, black sclerotia-like bodies, and a few radiating black hyphae. On and just below the surface of the media the black bodies were so abundant as to be indistinguishable, but in deeper layers they were more isolated and distinguishable as isolated black specks. The discoloration in cultures from potato resulted entirely from black,

[3] This fungus was isolated from diseased potatoes grown in western Canada.

[4] The fungus from maple was furnished by Mr. L. A. Zimm who isolated the organism from a maple tree which showed the thrombotic disease described by W. H. Rankin.

septate, more or less swollen hyphae such as are described by Klebahn[5] for *Verticillium albo-atrum* R. & B. All cultures showed an abundance of conidia and conidiophores, typical of the genus Verticillium.

INOCULATIONS

On January 17, 1917, the following inoculations were made in the greenhouse: ten one-year-old *Berberis thunbergii* seedlings, and six eggplant seedlings, about 7 inches high, were inoculated with a culture of the fungus isolated from barberry, four barberry seedlings and five eggplant seedlings were inoculated with a culture of Verticillium obtained from eggplant. Three eggplant and three barberry seedlings were injured with a sterilized knife for check. The inoculations were made by injuring the root of each plant just below the surface of the soil and introducing a small piece of an agar culture of the fungus. The lesion was then covered with soil.

After one month the foliage on the inoculated barberry seedlings was yellowish and on March 27, some of the leaves had dropped from certain plants. The tissue showed the characteristic reddish brown streaks. On the same date the inoculated eggplants were stunted in growth and the woody tissue inside the cortex of the stem was slightly darker and discolored as compared with the white woody tissue of the check plants. There was no difference between plants inoculated with the two cultures of fungi. About eighty per cent of all the barberry seedlings and eggplants were diseased. The check plants remained healthy. Isolations made from one of the diseased eggplants inoculated with the fungus from barberry yielded an organism similar to that used for inoculation.

On February 9, 1917, transfers of cultures of Verticillium from potato, barberry, maple (*Acer rubrum* L.) and eggplant were made to potato agar. On March 6, these cultures were used for inoculations and the results as shown in table 1 were recorded July 28.

TABLE 1

Inoculations with Verticillium cultures from different sources

SOURCE OF CULTURE	NUMBER OF PLANTS INOCULATED AND RESULT					
	Barberry		Eggplant		Maple	
	Number	Number diseased	Number	Number diseased	Number	Number diseased
From Barberry	3	3	4	3	3	2
From Eggplant	3	3	5	4	3	2
From Maple	3	0	4	0	3	3
From Potato	0	0	4	1	3	0
Checks	3	0	5	0	3	0

[5] Myc. Centbl. **3**: 64. 1913.

The *Berberis thunbergii* bushes were four years old, the eggplants about 4 inches high, and the maple seedlings three years old. The roots and shoots of the barberry and eggplant were inoculated; inoculations of the maple were made on the trunks of the trees. All lesions made above ground were covered with moist cotton.

The fungus from maple produced the disease only on maple, and no infection resulted from inoculation with the potato fungus except in the case of one eggplant. It is to be noted, however, that the characteristic potato fungus was reisolated from the single diseased eggplant. The barberry and eggplant fungi were reisolated from diseased eggplants.

On July 22, 1917 three potato plants 4 to 6 inches high were inoculated with each of two strains of the fungus obtained from potatoes. On October 6, five of the six plants showed browning of the vascular region. Several isolations from two of these plants yielded a fungus identical with that used for inoculation.

VARIETAL TESTS

In 1916 and 1917 all obtainable strains and varieties of cultivated eggplants were grown in a field severely infested with the Verticillium which attacks eggplant. The seed was obtained from the following sources—ten strains and varieties from four American seedsmen; ten varieties from Vilmorin-Andrieux & Cie, Paris, France; two varieties from Johnson & Son, England; six strains from China. Three to eight plants of each were grown. Every plant showed marked symptons of the disease and made only a stunted growth.

In 1917, one to six plants of various species of Solanaceæ were grown in the same field with the eggplants. Many of these developed the characteristic symptoms of the disease and a large number of isolations were made, the characteristic Verticillium fungus of eggplants being obtained from the following: Bonny Best tomato (*Lycopersicum esculentum* Mill.), currant tomato (*Lycopersicum pimpinellifolium* Dunal.), potato (*Solanum tuberosum* Linn.), *Solanum carolinense* L., *S. rostratum* Dunal., *S. integrifolium* Poir., *S. torvum* (wild eggplant from Porto Rico), *S. eleagnifolium* Cav., *S. marginatum* Linn., and *S. pyraconthum* Jacq.

The following plants showed no symptoms of the disease: *Solanum aviculare* Forst., *S. seaforthianum* Andr., *S. sisymbrufolium* Lam., *S. capsicastrum* Link., *S. dulcamara* L., *S. giganteum*, *S. betaceum*, and sweet pepper (*Capsicum annuum* L.).

Isolations were also made from potatoes from numerous nearby fields and the same organism obtained in every case.

SUMMARY

Cultures of Verticillium have been obtained from potato, eggplant, barberry, salsify and numerous species of Solanum, all grown in the vicinity of Rochester, New York, which are indistinguishable in rate of growth, macroscopic appearance of colonies, and formation of sclerotia-like bodies. Cultures from maple differ in the rate of formation of sclerotia-like bodies.

A fungus isolated from Canadian potatoes appears to be *Verticillium albo-atrum* R. & B., and the formation of sclerotia-like bodies on agar media differs from that of the fungus so common in the vicinity of Rochester.

UNIVERSITY OF ROCHESTER AND
CORNELL UNIVERSITY

BRIEFER ARTICLES

EXPERIMENTS FOR THE CONTROL OF BLACKSPOT AND POWDERY MILDEW OF ROSES

L. M. Massey

Diseases of ornamental plants usually have been studied either as an incident to other investigations or by mycologists interested in taxonomy. Many diseases of ornamentals are known but a method of controlling them usually is wanting, due doubtless to the fact that diseases of greater material value have claimed the attention of the pathologist and to the apparent natural aversion of the taxonomist to so-called practical work. It has been stated repeatedly in the popular literature of Experiment Stations and even in technical journals that the use of bordeaux mixture, or some other proprietary compound, should prove effective in the suppression of the specific disease under consideration. Ordinarily the conditions and needs either of the commercial florist or of the fancier have not been considered. The discoloration of a spray on plants and buildings may be more objectionable than the disease itself; the expense of protecting ornamentals from disease ordinarily is not an item for consideration.

These general remarks apply to the rose, one of the commonest ornamentals as well as one of the most valuable from the standpoint of commercial flower production.

The two important diseases of roses that can be suppressed by prophylactic treatments are blackspot and mildew. The suppression of mildew is readily accomplished, even by therapeutics, but the commonest recommendation found in the literature is that potassium sulfid be used as a spray. Many recommendations have been made for the control of blackspot but so far as can be determined from the literature the recommendations are not based on experimental evidence. The following experiments have been performed to determine what fungicides are effective in the control of the two diseases.

BLACKSPOT

Protection by spraying is the usual recommendation for the control of the disease of roses caused by *Diplocarpon Rosæ* Wolf. Of the numerous fungicides recommended in literature probably bordeaux mixture and ammoniacal copper carbonate are the two most often mentioned. State-

ments to the effect that the latter fungicide is as efficacious as the former are common in literature. Results of the following experiments conducted in 1917 indicate that ammoniacal copper carbonate is not as efficient as bordeaux mixture for the control of the disease. A mixture of 90 parts finely ground sulfur and 10 parts powdered arsenate of lead dusted upon the plants proved to be as efficient as bordeaux mixture and its use rendered the plants far less unsightly than the latter fungicide. Lime-sulfur solution, 1 part to 50 parts water, was found to be more efficient than ammoniacal copper carbonate and probably as much so as bordeaux mixture and the sulfur lead dust. However, lime-sulfur discolors the foliage almost as much as bordeaux mixture.

Experiments in the nursery

In the experiments performed in the nursery there were nine rows of rose plants, each of a single variety, the following eight varieties being involved: J. B. Clark, Gruss an Teplitz (2 rows), Prince Camille de Rohan, Clio, Mrs. John Laing, John Hopper, Madame Gabriel Luizet, and Margaret Dickson. A part of each row of plants was included in each of the different plats. There were 450 plants in each of the five plats which were treated as follows: plat 1, dusted with sulfur 90 parts and arsenate of lead 10 parts; plat 2, sprayed with bordeaux mixture, 5–5–50; plat 3, sprayed with lime-sulfur solution 1 to 50; plat 4, sprayed with Hammond's copper solution,[1] 1 to 100; plat 5, untreated.

The first applications of dust and spray were made on May 31. All of the buds had opened and most of the leaves were well developed on this date. Subsequent applications were made on June 12, June 23, July 4, July 24, August 2, and August 25. Final data were recorded on September 13, the middle row (variety Clio) being selected and the number of infected leaflets counted on twenty plants. The part of the row included in each plat consisted of approximately sixty plants, and the data were obtained from every other plant in the central area. Defoliation was not taken into consideration. From observations it was determined that the amount of defoliation varied directly with the percentage of leaflet infection in the various plats.

The percentage of diseased leaflets for each plat was as follows: sulfur 90 parts and arsenate of lead 10 parts, 7.66 ± 0.684[2]; bordeaux mixture

[1] Hammond's copper solution is a cupra-ammonium wash containing according to the manufacturer 3.05 per cent metallic copper.

[2] The probable error of the mean percentage was determined by means of Peter's formula, $\pm 0.8453 \frac{\Sigma v}{n\sqrt{n-1}}$, in which v equals the difference between the mean and the percentage of infected leaflets for each bush, and n equals the number of bushes from which records were taken.

5–5–50, 8.51 ± 0.904; lime-sulfur solution 1 to 50, 24.43 ± 1.309, Hammond's copper solution 1 to 100, 37.77 ± 1.6; untreated 80.3 ± 1.65.

A point to be noted in the above experiment is the fact that the plat treated with lime-sulfur solution was situated on low ground where there was poor drainage. Owing to heavy precipitation throughout the season these plants were subjected to more moist conditions than those in the other plats which had better drainage. Consequently it is probable that lime-sulfur is more efficient in the control of rose blackspot than the above results would indicate. This probability is further emphasized by the following experiments.

Experiments in the test garden of the American Rose Society

A somewhat similar experiment for the control of *Diplocarpon Rosæ* was conducted in the test garden of the American Rose Society at Ithaca, New York. Here the plants were arranged in beds, there being on an average, four varieties of six plants each in a bed. There were six plats, each of which included twelve beds, treated as follows: plat 1, dusted with sulfur 90 parts and arsenate of lead 10 parts; plat 2, sprayed with ammoniacal copper carbonate[3]; plat 3, sprayed with lime-sulfur 1 to 50; plat 4, sprayed with fungi-bordo[4] 5–5–50; plat 5, sprayed with Hammond's copper solution 1 to 100; plat 6, untreated.

During the summer thirteen treatments were made on the following dates: May 26, June 4, June 11, June 18, June 24, July 3, July 13, July 20, July 31, August 9, August 21, August 29, and September 9.

Final observations were made on September 24. Due to the fact that the plats did not contain the same varieties it was impossible to compare the treatments by determining the percentage of diseased leaflets. Gross observations were made by the writer who also obtained the opinion of the gardener and others not directly interested in the work. The plants of the dusted plat and those sprayed with fungi-bordo and lime-sulfur solution stood out in sharp contrast to the other plants in the garden due to their healthy leaves and heavy foliation. It was impossible to determine from gross observations which of these treatments was most efficient. The plats treated with ammoniacal copper carbonate and with Hammond's copper solution contained but slightly less affected plants than the check, and marked defoliation occurred in all three plats.

[3] The ammoniacal copper carbonate solution was composed of 5 ounces of copper carbonate, 3 pints of ammonium hydroxid (sp. gr. 0.90), and 50 gallons of water.

[4] Fungi-bordo is a dry, finely-ground, mixture of anhydrous copper sulfate and hydrated lime. It was used at the rate of 10 pounds to 50 gallons of water which is approximately equivalent to a 5–5–50 bordeaux mixture.

POWDERY MILDEW[5]

The efficiency of sulfur fungicides for the control of rose mildew has long been recognized. Lime-sulfur and other liquid sprays are more or less effective but owing to the time and labor involved in applying spray solutions and to the unsightliness brought about by their use, an efficient dust mixture is preferable. Stewart[6] in 1916 reports good control of rose mildew by the use of a dust mixture consisting of 90 parts sulfur and 10 parts arsenate of lead. A similar mixture was used by the writer in 1917 and it was found to be decidely more efficient than lime-sulfur solution 1 to 50 or bordeaux mixture 5–5–50.

A row of Crimson Rambler bushes planted thickly and forming an arbor about five hundred feet in length was divided into four sections of equal length and treated as follows: section 1, sprayed with bordeaux mixture 5–5–50; section 2, sprayed with lime-sulfur solution 1 to 50; section 3, dusted with sulfur 90 parts and arsenate of lead 10 parts; section 4, untreated.

The first application of dust and spray was made on August 2. Mildew appeared between this date and August 16, when the second application was made. Another application was made on August 25. The experiment was terminated on September 13. On this date the dusted bushes were practically free from mildew, only a few infected shoots being apparent. The bushes treated with bordeaux mixture and lime-sulfur were severely infected and were but slightly less free from the disease than the untreated bushes. Besides its superiority in fungicidal value the dust mixture rendered the plants far less unsightly than the bordeaux mixture or the lime-sulfur solution. The latter fungicide appeared to be slightly more efficient than bordeaux mixture.

CORNELL UNIVERSITY
ITHACA, NEW YORK.

[5] The mildew of roses is caused by the fungus *Sphærotheca pannosa* (Wallr.) Lév. var. *rosæ* Wor.

[6] Stewart, V. B. Experiment for the control of rose mildew. *In* Dusting nursery stock for the control of leaf diseases. New York (Cornell) Agr. Exp. Sta. Cir. 32:9. 1916.

A MACROPHOMA DISEASE OF FIGS

FREDERICK A. WOLF AND E. E. STANFORD

WITH TWO FIGURES IN THE TEXT

The twigs and larger limbs of the cultivated fig, *Ficus carica*, are subject to attack by several parasitic fungi which, in some cases, cause more or less serious injury. Edgerton[1] has discussed the presence, in Louisiana, of two of these diseases, namely, fig canker, caused by *Tubercularia fici* Edg., and limb blight, caused by *Corticium lætum* Karst. A recent paper by Matz[2] records the occurrence in Florida, of a disease of fig twigs, leaves, and fruit due to *Rhizoctonia microsclerotia* Matz. Furthermore, attention has been called by the senior writer[3] to a fig disease in Texas, due to *Macrophoma Fici* Alm. & S. Cam. which manifests itself by a dying back of the branches and a rotting of the fruit. Aside from these American accounts of diseases of the woody parts of figs, two foreign accounts only have been found. One of these consists of a brief report[4] by an anonymous writer who ascribes *Libertella ulcerata* as the cause of a twig disease in which the organism gains entrance through wounds. The other[5] makes brief mention of a disease of fig branches in which a species of Botrytis is regarded as the causal organism.

During the summer of 1916 the attention of the writers was called to a fig disease which manifests itself by the presence of cankers upon the larger limbs. These cankers appear to occur only on mature woody parts, never on the growth of the current season. They are characterized by a shrinking and drying out of the cortical tissues which later fall away, thus exposing the woody tissues beneath (fig. 1). The diseased areas are small at first and lenticular in outline, and attain a length of about 1 mm. before the outer bark is ruptured. The rupture of the cortex manifests itself by the formation of longitudinal fissures due presumably to desiccation of the cankerous tissue and to the increase in diameter through growth of the limb. These fissures extend finally into the wood which

[1] Edgerton, C. W. Diseases of the fig tree and fruit. Louisiana Agr. Exp. Sta. Bul. 126: 1–20, *pls. 8.*, 1911.

———. Two new fig diseases. Phytopath. **1:** 12–17, *pl. IV.* 1911.

[2] Matz, J. A Rhizoctonia of the fig. Phytopath. **7:** 110–117, *pl. ii, figs.* 1–3. 1917.

[3] Wolf, F. A. A disease of the cultivated fig, Ficus carica L. Ann. Mycol. **9:** 622–624, *figs. 1–3.* 1911.

[4] Anonymous. A disease of fig trees. Jour. Board Agr., London **17:** 47–49, *fig. 1.* 1910.

[5] Prunet, A. "A disease of the branches of fig." Compt. Rend. Acad. Sci., Paris **136:** 395–397. 1903.

becomes discolored and disintegrated. A roll of healthy cortical tissue on the margin of the open canker marks the tree's efforts to heal the wounds.

Several cankers may originate sufficiently near each other to become united as the cankers enlarge. The large cankers thus formed are 15 cm. or more in length and may extend laterally so that the branch is almost or entirely girdled. The distal portions of affected limbs may thus die as a result of this girdling. The leaves on such parts appear to wither suddenly and become dry. Not uncommonly, too, the limbs are so weakened at the points where the cankers occur that they are easily broken by the wind.

FIG. 1. CANKERS ON FIG BRANCHES CAUSED BY MACROPHOMA FICI × .5

Microscopic examination showed that several species of imperfect fungi were fruiting on the surface of or within the diseased tissues of these cankers. Among these were organisms referable to the genera Tubercularia, Phoma, Libertella and Macrophoma. Isolation in pure culture by the transfer of bits of cankerous tissue to plates of nutrient agar were therefore made in the hope of subsequently establishing the relationship of these organisms to this disease. On June 4, 1917, inoculations were made by the insertion of pycnidia or conidia from culture into clefts in the bark of fig cuttings which had been rooted during the previous winter

and spring. No cankers developed except in the case of inoculations with *Macrophoma* sp. On September 20 a species of Macrophoma was reisolated from the artificially produced cankers. It appeared in pure culture in all plantings of diseased tissue and was similar to the organism originally isolated. The mycelium on oat, bean, and potato agar is white at first, forming floccose colonies. After a few days, these colonies become grayish and at temperatures of 20 to 25°C. blackish pycnidia are formed in profusion. On oat hard agar or glucose agar, the mycelium becomes black with age and the substratum itself is blackened. Growth in culture is very similar to that of *Macrophoma Fici*, an organism which was originally[6] observed on twigs of *Ficus punctifera* in Africa, and which had been cultured in Texas in 1910 as previously reported.

The measurements of pycnidia are in accord with those of *Macrophoma Fici*. These pycnidia are found to vary from 200 to 300 μ whereas the

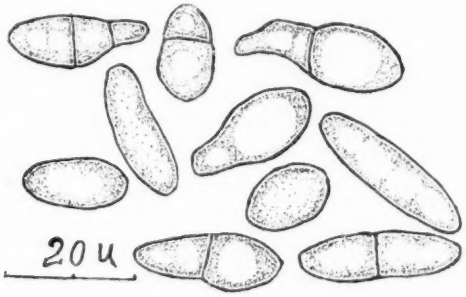


FIG. 2. CONIDIA OF MACROPHOMA FICI

All of these conidia are from the same pycnidium, and show the variation in size, form, and septation.

form observed in Texas ranged in size from 150 to 350 μ and the original description records a variation of 250 to 350 μ.

The conidia are variable in shape as seen in figure 2, a phenomenon to which attention was directed in the former account. The original description, moreover, of *Macrophoma Fici* states that the conidia are extremely variable in form in that they are ovoid, elliptical, elliptico-ovoid, cone shaped and pyriform. Conidia of all of these types occur within pycnidia on two-weeks-old glucose agar cultures and are illustrated in figure 2. The differences in size of conidia in the form from Texas and the organism in hand are not sufficient to permit of separation. The former were found to range in length from 22 to 28 μ and in width from

[6] d'Almeida J. V. and d'Souza da Camara, M. Duas especies mycologicas Africanas. Revista Agronomica **4**: 61, *pl. 1, figs. 4–5*. 1906.

10 to 12 μ, whereas corresponding measurements for the latter are 14 to 26 by 9 to 11 μ. The additional observation was made n the former study of the the occasional presence of septa. These too were not uncommonly noted in this study and are also represented in figure 2.

The germination of these conidia in agar potato broth, or fig decoction prepared by steeping fig branches, begins within five or six hours by the formation of a germ tube, and subsequent mycelial development is also entirely normal.

In order to determine whether the organism from fig cankers is capable of producing a rotting of the fruit, twigs bearing fruit were inoculated by placing the fungus from pure culture into the open end of fruits which had begun to ripen, and within four or five days the mycelium had thoroughly penetrated the tissues, causing them to be disintegrated, and pycnidia had begun to form. The freezing of the trees, in the winter of 1917, on which the limb cankers were first observed made it impossible to note whether the disease also appears under natural conditions upon fruits in North Carolina. It is very probable that such is the case however, in the light of the inoculation experiments just reported and the additional fact that figs are so easily subject to decay by a considerable number of fungi.

The organism associated with the formation of cankers on figs in North Carolina is therefore like the one identified as *Macrophoma Fici* Alm. & S. Cam., from Texas, in cultural characters, in size of pycnidia, in size, variation in form, and septation of conidia and in its ability to produce a decay of fig fruits. It is furthermore indistinguishable morphologically from *Macrophoma Fici* Alm. & S. Cam. from Africa with which it is believed to be identical.

ORANGE RUST OF RUBUS IN CANADA

R. E. STONE

WITH ONE FIGURE IN THE TEXT

In a recent publication the distribution of *Gymnoconia interstitialis* (Schlect.) Lagerh. was discussed.[1] Since in many places in the United States a similar but short-cycle form is of more economic mportance it may be of importance to record some data with regard to the orange rust occurring on *Rubus* spp. in Canada especially in Ontario.

In the spring of 1917, material was sent to the author from Grimsby, Ontario, on the southern shore of Lake Ontario. The rust occurred on cultivated red raspberries and cultivated blackberries. The rust was

[1] Arthur, J. C. Orange Rusts of Rubus. Bot. Gaz. **63**: 1–15.

especially severe on the blackberries. The plot of several acres was so badly diseased that the field had a decided orange-red appearance from a distance of twenty rods, most of the current year's growth being badly infected.

Spores of this orange rust from both raspberries and blackberries were sown on wet slides and kept in a moist chamber for two days, in order to observe their germination. In both cases the spores germinated readily and drawings were made of the germinating spores at the end of 12, 18,

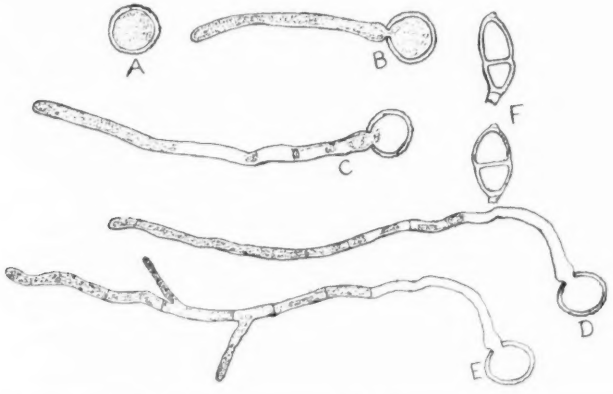


FIG. 1. AECIOSPORES AND TELIOSPORES OF GYMNOCONIA INTERSTITIALIS

A, Aeciospores from cultivated blackberry. *B*, *C*, *D*, and *E*, Germination of aeciospores after 12, 18, 36, and 48 hours, respectively. *F*, Teliospores from cultivated blackberry.

36 and 48 hours. As shown by the accompanying drawing there were no signs of promycelial formation. The germ-tubes formed were hypoid, showing that in this case the orange rust was the caeoma stage of the long-cycle form.

An attempt was made to infect both raspberries and blackberries but without success.

Later in the season the plot of blackberry plants was visited and on August 29, the telial stage of *Gymnoconia interstitialis* was collected.

From available material the collections of this species of rust from Canada are as follows:

Aecial hosts

Rubus occidentalis L., J. Dearness, London, Ontario, May 20, 1911.
———, J. Dearness, Glenora, Ontario, June 7, 1912.
Rubus strigosus Michx., C. F. Moore, Salisburg, N. B., July 2, 1905.
Rubus randii (Bailey) Rydb., W. P. Fraser, Pictous, N. S., August 1, 1908.

Rubus sp., (cultivated blackberry), Macoun, Muskoka, Ontario, June 24, 1890.
———, Macoun, Prince Edward Island, May 7, 1883.
———, J. E. Howitt, Grimsby, Ontario, June 24, 1916.
———, W. Robinson, Grimsby, Ontario, July 4, 1917.
Cultivated red raspberry, W. Robinson, Grimsby, Ontario, July 4, 1917.

Telial hosts

Rubus randii (Bailey) Rydb., W. P. Fraser, Pictou, N. S., August 1, 1908.
Rubus sp., cultivated blackberry, R. E. Stone, Grimsby, Ontario, August 29, 1917.

From the few collections listed, it is evident that more collections should be made with special attention given to securing the telial stage and also more studies made of the germination of the aeciospores.

ONTARIO AGRICULTURAL COLLEGE
GUELPH, ONTARIO

INFLUENCE OF MOISTURE AND TEMPERATURE UPON INFECTION BY SPONGOSPORA SUBTERRANEA

G. B. RAMSEY

Ever since the appearance of powdery scab in the United States the disease has been a matter of great interest in Maine as well as in practically all other potato growing regions of this country. Unfamiliarity with the causal organism, *Spongospora subterranea* (Wallr.) Johnson, its complete life history and the climatic conditions influencing its progress caused considerable extensive as well as intensive study to be focused upon it. Field experiments together with observations under normal farm culture, have given uniform results and show that only in rare or exceptional years may powdery scab be expected to develop to any considerable extent in Maine. Moreover, it has never appeared in this State, except in the northern and extreme eastern parts where the summers are relatively cool and wet. Pathologists who have had experience with this disease agree that there is little if any damage to be expected from it unless three essential factors are present. First, cool climatic conditions, especially during the first half of the growing season; second, medium to abundant rain-fall during this period, third, at least in Maine, a low, gray type of soil which seems to be most favorable for the fungus.

In 1916 the exceptionally dry and hot season proved so unfavorable for the development of the disease that it was almost impossible to find any scab even on potatoes grown in the most favorable soil and where abundant scab had appeared the year before. Experiments especially designed for powdery scab, even where badly infected tubers were planted, proved

almost a total failure. In visiting several fields in Aroostook county at digging time in the fall of 1916, where the disease was known to have been found the year previous, the writer was unable, with one exception, to find any powdery scab whatsoever. This infected area was small and since it was not pointed out to the farmer no doubt it was entirely overlooked by him at harvest time.

Having a suitable type of infested soil as a constant factor, a greenhouse experiment was devised in the winter of 1916–1917 whereby it was hoped that by varying the conditions of heat and moisture, more definite information might be obtained regarding the influence exerted by these two factors. Three rooms of the greenhouse were so arranged that, by manipulating the heating system, rather widely different temperatures could be maintained. It was decided to emphasize these differences so that field conditions that occur in Maine or in other parts of the country in various years might be duplicated, at least in part. One room to represent a cold season or climate was maintained at a temperature of approximately 60°F. throughout the growing period; a second room was kept at a temperature of 70°F. or what was supposed to duplicate a normal season; the third room, representing a hot season, was kept at a temperature of approximately 80°F.

Variations in moisture content were made by watering the individual pots with a hand sprinkler. Nine pots were placed in each of the three rooms, three pots composing a set. Three were kept as dry as practicable and yet allow the plants to grow, to represent a dry season; three were given a medium amount of moisture, representing a normal season; and three were given abundant moisture at all times so that what corresponded to a wet season was maintained throughout the growing period.

A strain of Green Mountain potatoes was used in the experiment, a whole tuber being planted in each 10-inch pot. The soil was known to be infested with Spongospora, having been saved from greenhouse experiments of the previous year and placed in barrels where it was kept moist. Before planting, this soil was thoroughly mixed and moistened so that it was uniform throughout. In order that all of the plants might get an equal start, all of the pots were placed in the room with a temperature of 70° and given a medium amount of moisture until the plants were well through the ground. The pots were then numbered and divided into groups, nine pots in each of the three rooms.

Temperature records of both the soil and the air in each room were taken three times daily; eight o'clock in the morning, twelve o'clock noon and at five o'clock in the afternoon. At night the temperatures were proportionately lower, corresponding somewhat to night temperatures of field conditions. While it was not always possible to maintain the more

or less ideal conditions set forth in the plan outlined, at no time however, was there any great variation that would unbalance the experiment. The average day temperature remained quite constant. Except at rare and short intervals there was never a fluctuation of more than 5° from the degree of heat chosen for any given room. The average temperature for the fourteen weeks in the cold room was,—soil 57°, air 60°, normal room, soil 63°, air 70°; hot room, soil 76°, air 80°.

Realizing that too general conclusions should not be made from an experiment conducted upon such a small scale, the writer offers the following results for what they are worth. Tuber infection was found in five out of the six pots grown in the cold room where the pots had received medium to abundant moisture. No other infection could be found in any of the dry pots of that room or in any pots whatever in the rooms of higher temperatures. Every tuber was carefully examined and all those having suspicious eruptions were placed aside and examined microscopically for final determination. Resulting counts showed 83 per cent infection in the pots grown under cool, moist conditions, as against no infection in those pots where the temperature was higher or the soil too dry. Pots with the required amount of moisture but with the temperature too high did not show infection even in the slightest degree. Pots with the right degree of temperature but with the moisture content lacking did not show infection. The experiment seems to show that a cool, moist season or climate is most favorable to the development of the powdery scab organism, and that it will not develop to any marked extent, if at all, under any other conditions.

As an experiment conducted under controlled conditions and as supporting field experiments and observations, it is hoped this work will be of some value to the practical man as well as those having a purely scientific interest in *Spongospora subterranea*.

MAINE AGRICULTURAL EXPERIMENT STATION
ORONO, MAINE

PHYTOPATHOLOGICAL NOTES

Hosts of the white pickle mosaic disease of cucumber. Inoculations were made in 1916 and 1917 by rubbing crushed leaves from cucumber plants affected with the white pickle mosaic disease over the leaves of numerous related plants. All inoculations were made in a greenhouse. At least an equal number of similar plants were rubbed with crushed leaves from healthy cucumber plants as checks, and in every case all remained healthy. Cucumbers became infected by similar inoculation from several of the infected species and varieties. Infection was obtained on the following plants of the family Cucurbitaceæ: *Cucumis sativus* Linn. (4 varieties of cucumber); *Cucurbita moschata* Duchesne, *pepo* Linn., and *maxima* Duchesne (14 varieties of pumpkins, squashes and gourds); *Cucumis melo* Linn. (9 varieties of muskmelon and snake cucumber); *Lagenaria vulgaris* Ser. (2 varieties of gourds); *Citrullus vulgaris* Schrad. (green seeded citron); *Cucumis anguria* Linn. (bur cucumber or West Indian gherkin); *Luffa* sp. (dish-cloth gourd); *Benincasa hispida* Cog., *Melothria scabra* Naudin, *Momordica balsamina* Linn., *Trichosanthes anguina* Linn.

All infected plants showed a yellow and green mottling, but the degree and pattern varied on different species and varieties. Likewise all were stunted and the degree of stunting varied from slight to very marked. Some showed mottling of stalks, petioles, and fruits, while in others the mottling was confined to the leaves.

Repeated inoculations were made on *Ecballium elaterium* A. Rich. and red seeded citron (*Citrullus vulgaris* Schrad.), but infection was never obtained. In 1916 two inoculated Cole's Early watermelon (*Citrullus vulgaris* Schrad.) plants developed characteristic mottling and stunting, while several check plants remained healthy, but no inoculations were made from the watermelon on cucumber. In 1917 repeated inoculations failed to yield infection on the same variety of watermelon. With the exception of the above, all species and varieties of this family inoculated have yielded infection.

The wide susceptibility in the family Curcurbitaceæ suggested the possibility of members of related families being infected. A limited number of small plants belonging to the families Campanulaceæ, Lobeliaceæ and Compositæ were inoculated and infection obtained on single species of the last two families. In Gray's Manual of Botany these three families and Cucurbitaceæ constitute the order Campanulales. *Helianthus debilis* Nutt. (cucumber-leaved sunflower, a native of southern United States)

showed a decided mottling and more or less crinkling of the leaves, similar to the symptoms on cucumber, and the plants were considerably stunted. *Lobelia erinus* Linn. var *gracilis* (a small trailing ornamental plant) showed comparatively large and few yellowish blotches in the leaves and there was little or no stunting of the plants. Check plants of both species remained healthy. Reinfection was repeatedly obtained on cucumber from both infected plants of both species.

IVAN C. JAGGER

Pathogenicity of Bacillus amylovorus (Burr.) Trev. for blossoms of the strawberry (Fragaria sp.). During the past year the writer had an opportunity to test the pathogenicity of the organism causing the fire blight of pear (*Bacillus amylovorus*) for blossoms of the strawberry. Plants of both the cultivated and the wild strawberry were transplanted to 4-inch pots in a greenhouse. Blossom inoculations were made by spraying the plants with a forty-eight-hours-old broth culture of the organism. Checks were run by spraying other blossoms with sterilized water, while adjoining blossoms were left untreated. After forty-eight hours the inoculated blossoms showed signs of disease, and after three days all of the floral parts had become involved and were badly blackened or blighted. None of the checks became diseased. Blossoms were also caused to blight by gently rubbing the nectarial surfaces with a platinum loop dipped into a forty-eight-hours-old culture of the organism. Drops from bouillon cultures of the organism placed on leaves of the plants gave negative results in every instance. From the results of these tests, together with those obtained in the field, it seems safe to conclude that the fire blight organism may cause a blight of the blossoms of the strawberry. No injury was necessary when the bacilli were sprayed or placed upon the open blossoms. So far as the writer is able to discover this has not been noted as having occurred in nature.

M. T. MUNN

The Phoma blight of red cedar. In a recent paper Hahn, Hartley and Pierce[1] have described a blight of cedars caused by a species of Phoma. According to this account, the earliest known occurrence of the disease is one observed by Hedgcock in 1900.

The present writer has knowledge of its occurrence a few years earlier. In June, 1896, a nurseryman of Kent, Iowa, wrote to the New York (State) Experiment Station about a disease which had caused the death of a large

[1] Hahn, G. C., Hartley, C., and Pierce, R. G. A nursery blight of cedars. Jour. Agr. Research **10**: 533–539. 1917.

number of small red cedar (*Juniperus virginiana*) trees in his nursery the previous year and was beginning to reappear. This letter and the specimens of diseased trees which accompanied it were referred to the writer. A careful examination of the specimens led to the conclusion that the trouble was due to a species of Phoma, the pycnidia of which were to be found in abundance on the leaves and bark of affected branches. The sender was so informed and advised to spray the trees with Bordeaux mixture.

The following season further correspondence was had with the Iowa nurseryman. He reported that the disease continued to be destructive during 1896 and 1897 in spite of frequent, thorough spraying with Bordeaux mixture. From additional specimens received this year the cause of the trouble was again ascribed to Phoma.

Subsequently, it was learned that in 1896 the same nurseyman had sent specimens of the diseased cedars to the New York (Cornell) Experiment Station, where they were referred to Dr. B. M. Duggar, at that time Assistant Botanist of the Station. Dr. Duggar obtained pure cultures of the Phoma and started some inoculation experiments, but the work was discontinued before definite results were obtained. Neither Dr. Duggar nor the writer has made any observations on the disease since 1897.

Some of the specimens received in 1896 and 1897 have been preserved in the herbarium of the New York (State) Experiment Station. They show well the characters of the disease. Undoubtedly, it is the same as the disease described by Hahn, Hartley and Pierce.

F. C. STEWART

Susceptibility of Zanthoxylum clava-hercules to Bacterium citri. A number of needle-prick inoculations were made in the twigs and leaves of *Zanthoxylum clava-hercules* (southern prickly ash) with pure cultures of *Bacterium citri* Hasse. As a result of these inoculations, cankers developed on the twigs, petioles, and veins, which were identical in appearance with those produced on the twigs of *Zanthoxylum fagara* (L.) Sarg. in a similar manner and described by the writer in a previous article.[1] Pure cultures of *Bacterium citri* were recovered from the interior of these cankers, and typical infections of citrus canker resulted when they were introduced into the tissues of grapefruit seedlings. Suspensions of *B. citri* in sterilized water were also sprayed on the surface of *Z. clava-hercules* but the plants were unfortunately injured by spraying before the results could be determined. However, *Z. clava-hercules* is just as susceptible to citrus canker

[1] Jehle, R. A. Susceptibility of non-citrus plants to Bacterium citri. Phytopathology **7**: 339–345. 1917.

as *Z. fagara* when the organisms are introduced into the tissues, and it is likely that it is susceptible when the organisms are sprayed on the surface.

R. A. JEHLE

Dispersal distance of urediniospores of Cronartium ribicola as indicated by their rate of fall in still air. The transport in air currents of the spores of *Cronartium ribicola* is one of the most important factors in the spread

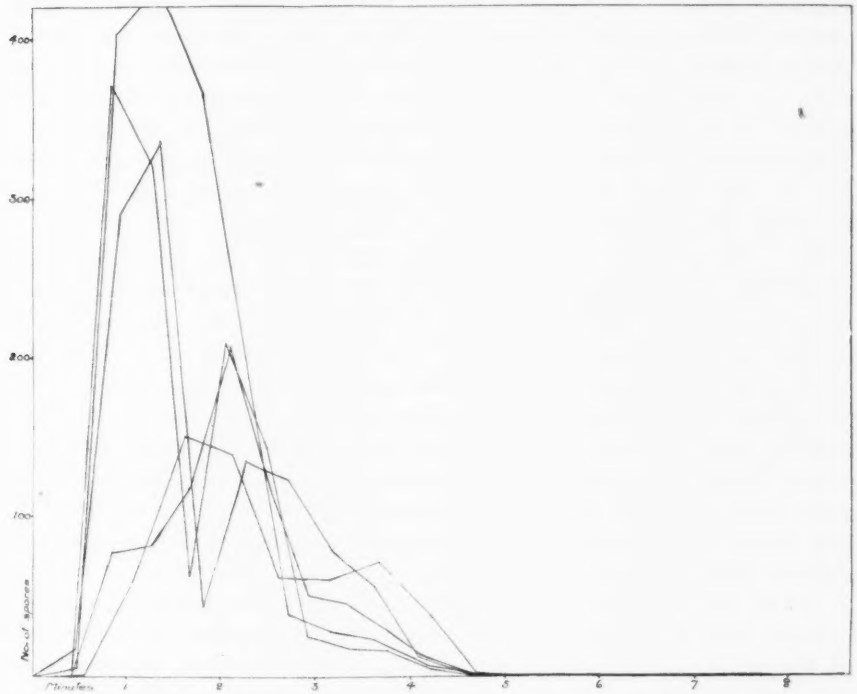


FIG. 1. GRAPH RECORDING THE TIME REQUIRED BY AIR-DRIED UREDINIOSPORES OF CRONARTIUM RIBICOLA TO FALL A DISTANCE OF 8 FEET THROUGH STILL AIR

of the blister rust disease, and all date bearing on the wind dispersal distance are of immediate value in shaping control measures.

A spore adrift in an air current is acted on by two forces—the horizontal pressure of the wind and the downward pull of gravity—and it will, theoretically, follow a path representing the resultant of these two forces. The problem of wind velocity presents no difficulty and therefore if we can determine the rate of fall of the spore in still air, it easy to compute the theoretical dispersal distance for a spore liberated at any given height. The following results were obtained from a set of experiments devised to determine the rate of fall of the urediniospores in still air.

In determining the time of spore fall air-dried spores were released instantaneously and automatically at the upper end of a long cardboard tube 9 inches in diameter. A flat disk revolving slowly and uniformly below this tube carried glass slides filmed with glycerin under an opening in the lower end. The distance from the point of release to the surface of these slides was exactly 8 feet. A small projecting pin on the revolving disk tripped the release apparatus at the beginning of a revolution and as the slides passed successively under the tube they caught the falling spores. The glycerin film was then scraped carefully into a line in the center of the slide, the spores counted, and their number recorded in graph form. In the accompanying graph table it is seen that there are many irregularities in the beginnings of the five members of the series, due to the falling of clumps of spores. Towards the last however the series exhibits considerable uniformity, and it is apparent that the spores cease to fall on the slides between four and five minutes after their release.

Since the problem of spore dispersal is vitally a question of the maximum dispersal distance, the chief interest in the above results centers around those spores which fall most slowly, and therefore are likely to be carried farthest in air currents. If such spores take approximately five minutes to fall a distance of 8 feet one may get some idea of their transport distance by noting that in five minutes a 30 mile breeze would have carried them $2\frac{1}{2}$ miles. In other words if these spores were set free 8 feet above the surface of a level plain, a 30 mile breeze would carry them $2\frac{1}{2}$ miles before they could sink to earth, or if liberated from a small hill 32 feet above the plain they would be carried 10 miles by the same breeze before being deposited.

In addition to this simple theoretical result, arrived at by resolution of the two forces acting on a free spore, there should be taken into account some of the factors which would tend to divert the falling spore from the path indicated. Hills, buildings, and foliage screens would interrupt its course, while deflections of the wind or rising masses of heated air would tend to carry it upward and thus increase the possibility of transport by horizontal air currents. How much the action of these disturbing agencies would increase the dispersal distance is a matter of conjecture, but since the forces exerted by these various agencies are in most cases of vast magnitude compared with the feeble effect produced on the spore by the pull of gravity against air resistance, one may justly assume that very great diversions from the theoretical path are quite likely to occur. And since some of these diversions are sure to be favorable to further transport, it appears certain that the radius of dispersal of the urediniospores of *Cronartium ribicola* must be considered in terms of miles rather than of yards.

W. A. MCCUBBIN

A note on Hyalopsoræ. The Hyalopsora fern rusts are very abundant in the western mountains and apparently should have alternate stages. So far, the results of infection experiments indicate that this rust is autoecious. Bubak[1] failed to infect species of Abies and Pinus with Hyalopsora, and Dietel,[2] working with *Hyalopsora polypodii* (Pers.) Magn., failed to discover an alternate host. Arthur's statement,[3] "telia and two other spore-forms known, for convenience called aecia and uredinia," implies that although the nature of these spore-forms is not understood, the complete cycle of development is passed on the fern. Bartholomew[4] comes to the conclusion, after determining both the thick- and thin-walled spores, that this rust has an alternate stage to be found on conifers. Dietel[5] found by experiments that the fungus winters over on the ferns by means of urediniospores. He states that in some regions this is the only method by which the fungus propagates.

Bubak and Klebahn[6] endeavored to infect species of Abies, Picea, Larix, and Pinus with telia of *H. aspidiotus* (Pk.) Magn. but without success.

That these rusts are autoecious is here demonstrated by the writers for at least two of the described species. After repeated efforts to produce infections by means of the various spore-forms on species of Abies, Tsuga, and Pteridium without result, the following observations and experiments were made. On October 14, 1916, a quantity of the rhizomes of *Phegopteris dryopteris* which had during the summer produced plants heavily infected with *H. aspidiotus* (Peck) Magn. were transplanted in pots to the greenhouse at the Forest Pathology Field Station, Missoula, Montana. This fern is not evergreen and a quantity of the dead leaves bearing the internal telia, together with a quantity of the forest duff, were thrown over the surface of the pots. During the spring of the present year the rhizomes produced plants abundantly. On May 8, 1917, these plants were found to be infected with the uredinial stage of the rust. The chances of outside infection were at a minimum under the conditions in which the plants were kept in the greenhouse. Hence, it is assumed that the infection resulted from the over-wintered spores on the dead fronds about the

[1] Bubak, F. Infektionsversuche mit einigen Uredineen. Centbl. Bakt. II Abt., **12**: 411–426. 1904; and **16**: 150–159. 1908.

[2] Dietel, P. Ueber einige Kulturversuche mit Hyalopsora polypodii (Pers.) Magn. Ann. Mycol. **9**: 530–533. 1911.

[3] Arthur, J. C. Uredinales. North American Flora **7**: 112. 1907.

[4] Bartholomew, E. T. Observations on the fern rust Hyalopsora polypodii. Bul. Torrey Bot. Club. **43**: 195–199. My. 1916.

[5] Dietel. Loc. cit.

[6] No citations. Referred to in Sydow P. and H. Monographia Uredinearum **3**: Fasc. 3. 1915.

new plants. This view is further supported by the observation in nature that this rust always appears very early in the spring (April and May) in dense groups of these ferns where no other possible host plants grow. No perennial mycelium has been observed in the rhizomes of the ferns. The uredinia from the ferns in the greenhouse were transferred on May 10, 1917, to plants of the same species which had been in the culture house for two years and were free from the rust, with the result that they were found infected on May 31, 1917. The resultant spore form is identical with the spores used in making the inoculation. The fern plant originally found infected has developed urediniosori continually since the date of first observance of the rust, and, on the last day examined, September 4, 1917, the majority of the leaves and also a few of the stems were found infected. The finding of infections on the stems may be important in relation to the over-wintering habit, as it indicates that the fungus is able to continue through the winter on whatever portions of the plant are exposed and capable of infection. This leads to the conclusion that the rust winters over on the fern and may propagate itself during the summer on the same host by means of uredinia.

In rock crevices about the lake shore at Coeur d'Alene, Idaho, *Woodsia scopulina* is annually infected with *Hyalopsora polypodii* (DC.) Magn. In a similar habitat about Spokane, Washington, this fern occurs in abundance but is always free from the rust. On April 25, 1917, a quantity of the dead leaves and forest débris from the infected fern beds at Coeur d'Alene was placed in a clump of the ferns at Spokane. These ferns were examined on June 19 and were found to be moderately infected with the uredinial stage of the rust.

The foregoing observations indicate that *H. aspidiotus* and *H. polypodii* have no alternate host, winter over by means of telia, and are propagated during the summer by means of uredinia.

JAMES R. WEIR AND ERNEST E. HUBERT

Plant pathology in the Union of South Africa. A "Mycological laboratory" has been established at Durban for the study of diseases of tropical and subtropical crops. The work at present relates primarily to sugar cane, although citrus, pawpaw, and other crops also receive attention. In addition to the Mycological laboratory there is the Natal Herbarium, containing over 50,000 specimens of South African and foreign plants. Dr. J. van der Byl is in charge. Address Mycologist in charge Natal Herbarium, Botanic Garden Road, Durban, Natal.

Physoderma (Zeæ Maydis?) in Kansas. In the fall of 1915 (September) the writer collected some material of what appeared to be a Physoderma

on corn. A report was made to the Plant Disease Survey, at that time and the card was marked Physoderma (?) on corn. Specimens however, were not submitted for microscopic examination.

This fungus was noticed by Mr. A. A. Potter and the writer in a cornfield where a date-of-planting test was being conducted. It looked suspicious and material was gathered by the writer for examination. Not being entirely familiar with the symptoms of the disease, specimens were shown to others who did not believe it to be the Physoderma disease, therefore, the specimens were laid aside for further examination. Recently Dr. Weston made a visit to Manhattan and the specimens were shown to him. He verified them as being Physoderma (Zeæ Maydis?). A visit was made to the same field where the disease occurred in 1915, but careful search only revealed a very slight trace of it on one or two plants.

The field in 1915 showed considerable of this disease but no apparent injury to the plants could be noticed. The season was wet and cool and in this respect somewhat different from the past two seasons.

At the time that the specimens were first found (1915) in Kansas, the writer has been informed that this was the third state in the Union in which the disease occurs. It has not been thought that the Physoderma disease would be found as far north as Kansas, but this information shows differently.

L. E. MELCHERS

LITERATURE ON PLANT DISEASES[1]

COMPILED BY EUNICE R. OBERLY, LIBRARIAN, BUREAU OF PLANT INDUSTRY, AND FLORENCE P. SMITH, ASSISTANT

October, 1917

Belgrave, W. N. C. Root diseases of Hevea and clean clearing. Agr. Bul. Straits and Fed. Malay States **5**: 318-326. My/Je. 1917.

Brigham, Reed O. Sterilization of pop corn. 17th Rpt. Michigan Acad. Sci. **[1915]**: 190-193. 1916.

Literature, p. 192-193.

Bruner, Stephen C. A new species of Endothia. Mycologia **8**: 239-242, pl. 192. S. 1916.

Endothia havanensis sp. nov.

Campbell, J. A. Root-knot of fruit-trees. Importation of Australian trees prohibited. Jour. Agr. [N. Zeal.] **15**: 63-68, illus. Ag. 1917.

Bacterium tumefaciens.

[1] This list includes references, both American and foreign, to the literature of plant pathology and mycology of interest to pathologists. Foreign references published since January 1, 1917, have been included beginning with the list appearing in v. 7, no. 3, June, 1917.

All authors are urged to coöperate in making the list complete by sending their separates and by making corrections and additions, and especially by calling attention to meritorious articles published outside of regular journals. Reprints or correspondence should be addressed to Miss E. R. Oberly, Librarian, Bureau of Plant Industry, U. S. Dept. Agric., Washington, D. C.

Clinton, George Perkins. Cooperative potato spraying 1916. Connecticut Agr. Expt. Sta. Ann. Rpt. **1916**: 355-364. 1917.

" . . . . to test the relative merits of Bordeaux mixture and Pyrox, in spraying Green Mountain potatoes for the blight, etc., under ordinary farming conditions."

Cobb, Nathan Augustus. A new parasitic nema found infesting cotton and potatoes. Jour. Agr. Research **11**: 27-33, 5 fig. O. 1, 1917.

Tylenchus penetrans n. sp.

Cocns, George Herbert. The Michigan plant disease survey for 1914. 17th Rpt. Michigan Acad. Sci. [**1915**]: 123-133. 1916.

——— An undescribed bark canker of apple and the associated organism. 17th Rpt. Michigan Acad. Sci. [**1915**]: 117-122. 1916.

Plenodomus fuscomaculans (Sacc.) n. comb.

Doolittle, S. P. Cucumber scab caused by Cladosporium cucumerinum. 17th Rpt. Michigan Acad. Sci. [**1915**]: 87-116. 1916.

Literature, p. 116.

Elliott, John Asbury. An Alternaria on Sonchus. Bot. Gaz. **62**: 414-416, 1 fig. N. 1916.

Alternaria Sonchi Davis, sp. nov.

——— Taxonomic characters of the genera Alternaria and Macrosporium. Amer. Jour. Bot. **4**: 439-476, 6 fig., pl. 19-20. O. 1917.

Erwin, Arthur Thomas. Bordeaux mixture for the tip burn and early blight of potatoes. Iowa Agr. Expt. Sta. Bul. 171, p. 63-75. [1917.]

Esam, G. Brown-rot of fruit. Investigations in Hawke's Bay. Jour. Agr. [N. Zeal.] **15**: 84-89. Ag. 1917.

Fawcett, Howard S. The geographical distribution of the citrus diseases, melanose and stem-end rot. Johns Hopkins Univ. Circ. 293 (n. s. no. 3): 190-193. Mr. 1917.

——— Preliminary note on the relation of temperatures to the growth of certain parasitic fungi in cultures. Johns Hopkins Univ. Circ. 293 (n. s. no. 3): 193-194. Mr. 1917.

Fields, W. S. Method for photographing culture plates. Phytopathology **7**: 388, 1 fig. O. 1917.

Floyd, Bayard Franklin. Dieback, or exanthema of citrus trees. Florida Agr. Expt. Sta. Bul. 140, 31 p., illus. 1917.

Gravatt, George Flippo, and **Marshall, Rush P.** Arthropods and gasteropods as carriers of Cronartium ribicola in greenhouses. Phytopathology **7**: 368-373. O. 1917.

Grossenbacher, John Gasser. Crown-rot of fruit trees: histological studies. Amer. Jour. Bot. **4**: 477-512, pl. 21-27. O. 1917.

Bibliographical footnotes.

Hall, Constant Johan Jacob van. De bestrijding van den cacaokanker op de onderneming "Kemiri." Meded. Lab. Plantenz. [Batavia] 30, 10 p. 1917.

Haskell, Royal Joslyn. The spray method of applying concentrated formaldehyde solution in the control of oat smut. Phytopathology **7**: 381-383. O. 1917.

Hawkins, Lon Adrian. Experiments in the control of potato leak. U. S. Dept. Agr. Bul. 577, 5 p. 1917.

Pythium debaryanum.

Helmsing, I. W. A fungoid disease attacking pears. Jour. Agr. [N. Zeal.] **15**: 96-97. Ag. 1917.

Entomosporium maculatum.

Hungerford, Charles W. Field conference of cereal pathologists. Science n. s. **46:** 316-318. S. 28, 1917.

Third annual field conference of cereal pathologists of the American phytopathological society, Madison, Wisconsin, July 9-11, 1917.

Summaries of round-table discussions; Grass rusts and their rôle in cereal conservation; Federal and state legislation against the barberry; State and federal cooperation in fighting cereal diseases during our food emergency; Paper on "Recent investigations on yellow stripe rust," by Charles W. Hungerford.

Jackson, Herbert Spencer. Two new forest tree rusts from the Northwest. Phytopathology **7:** 352-355. O. 1917.

Chrysomyxa weirii sp. nov.; *Melampsora occidentalis* sp. nov.

Jehle, Robert Andrew. Susceptibility of non-citrus plants to Bacterium Citri. Phytopathology **7:** 339-344, 3 fig. O. 1917.

Kauffman, Calvin Henry. Unreported Michigan fungi for 1911, 1912, 1913 and 1914. 17th Rpt. Michigan Acad. Sci. [**1915**]: 194-223. 1916.

——— and **Mains, Edwin Butterworth.** An epidemic of Cronartium comptoniæ at the Roscommon state nurseries. 17th Rpt. Michigan Acad. Sci. [**1915**]: 188-189. 1916.

Kellerman, Karl Frederic. Cooperative work for eradicating citrus canker. U. S. Dept. Agr. Yearbook **1916:** 267-272, pl. 59-62. 1917.

Levin, Ezra. Control of lettuce rot. Phytopathology **7:** 392-393. O. 1917.

Lind, Jens. Hundegraes-bakteriosen (Aplanobacter rathayi). Tidsskr. Planteavl **24:** 254-263. 1917.

Litteraturfortegnelse, p. 263.

Beretning fra Statens forsgsvirksomhedøi plantekultur 115.

McCubbin, W. A., and **Posey, G. G.** Development of blister rust aecia on white pines after they had been cut down. Phytopathology **7:** 391-393. O. 1917.

Mackie, D. B. New disease of the pineapple reported. Philippine Agr. Rev. **10:** 150, pl. 17. 1917.

Undetermined.

Mains, Edwin Butterworth. Some factors concerned in the germination of rust spores. 17th Rpt. Michigan Acad. Sci. [**1915**]: 136-140. 1916.

Meinecke, Emilio Pepe Michael. The white pine blister rust and the chestnut bark disease. Mo. Bul. State Com. Hort. [California] **6:** 268-279, fig. 76-84. Jy. 1917.

Miles, Lee Ellis. Some diseases of economic plants in Porto Rico. Phytopathology **7:** 345-351, 3 fig. O. 1917.

Newell, Wilmon. Citrus canker. Mo. Bul. State Com. Hort. [California] **6:** 263-268, fig. 74-75, pl. 1-3 (col.). Jy. 1917.

Norton, John Bitting Smith. Peach yellows and peach rosette. Mo. Bul. State Com. Hort. [California] **6:** 282-286, fig. 87-89. Jy. 1917.

Orton, Clayton Roberts, and **McKinney, W. H.** Winter blight of the tomato. Pennsylvania Agr. Expt. Sta. Rpt. **1914/15:** 233-246, 6 pl. 1916.

Bibliography, p. 245.

Three theories have been advanced as explanations for the causes of the disease. Considerable work has been done on these theories but the cause is still in doubt.

Rands, Robert Delafield. Alternaria on Datura and potato. Phytopathology **7:** 327-338, 4 fig. O. 1917.

Literature cited, p. 338.

Differentiates fungus causing leaf-spot of Jimson weed as *Alternaria crassa* (Sacc.) n. comb.

Richards, R. M. The diseases and pests of the coconut palm. Agr. Bul. Straits and Fed. Malay States **5**: 327-337. My/Je. 1917.

——— Diseases of the leaves and stem of Hevea brasiliensis in the Malay peninsula. Agr. Bul. Straits and Fed. Malay States **5**: 307-317. My/Je. 1917.

Ridgway, Charles S. Methods for the differentiation of pathogenic fungi in the tissues of the host. Phytopathology **7**: 389-391. O. 1917.

Rogers, John M., and **Earle, Franklin Sumner.** A simple and effective method of protecting citrus fruits against stem-end rot. Phytopathology **7**: 361-367. O. 1917.

Savelli, Martino. Cystopodaceae e Peronosporaceae toscane. Bul. Soc. Bot. Ital. **1917**: 13-19. Ja. 1917.

Bibliografia, p. 15-19.

——— Su due forme di Pestalozzia. Bul. Soc. Bot. Ital. **1917**: 62-68, illus. Je/Jy. 1917.

P. lucae, P. feijoae.

——— Su una Puccinia parassiti dell' Iris flavescens. Bull. Soc. Bot. Ital. **1917**: 11-13. Ja. 1917..

Puccinia caucasica n. sp.

——— Sulla scoperta in Italia della Puccinia malvacearum Mont. Bul. Soc. Bot. Ital. **1917**: 84. Ag./S. 1917.

Schmitz, Henry. Some observations on witches brooms of cherries. Plant World **19**: 239-242. Ag. 1916.

Exoascus cerasi.

Shapovalov, Michael. Intoxicating bread. N. A. Naumov. P'iany Khlieb (Intoxicating bread). Trudy Biuro po Mik. i. Fitopat. no. 12, pp. 1-216, pls. I-VIII, Petrograd, 1916. A. Pomasski. Ob Izmienen. Khim. Sostava Rzhi pod Vliian. Zhizn. Niekot. Form Fusarium (Chemical changes in rye due to the activities of certain forms of Fusarium) Soobshch. Biuro po Chastn. Rasten. no. 1 (1916), pp. 1-32, Petrograd, 1916. Phytopathology **7**: 384-386. O. 1917.

Extended review of two Russian articles.

Shear, Cornelius Lott. Endrot of cranberries. Jour. Agr. Research **11**: 35-42, 33 fig., pl. A. O. 8, 1917.

Fusicoccum putrefaciens n. sp.

Shelton-Agar, W. R. Clean clearing, pests and diseases. Agr. Bul. Straits and Fed. Malay States **5**: 300-306. My/Je. 1917.

Siggers, P. V. Some cultural characteristics of Pestalozzia funera [i.e. funerea] Desm. 17th Rpt. Michigan Acad. Sci. [**1915**]: 141. 1916.

Smith, Erwin Frink. Further evidence as to the relation between crown gall and cancer. Proc. Nat. Acad. Sci. **2**: 444-448. Ag. 1916.

Sorauer, Paul. Manual of Plant Diseases. ed. 3. Trans. by Frances Dorrance. v. 1, pt. 7. Wilkes-Barré, Pennsylvania, 1917.

Spaulding, Perley and **Gravatt, George Flippo.** Inoculations on Ribis with Cronartium ribicola Fischer. Science n. s. **46**: 243-244. S. 7, 1917.

Stevenson, John A. Cane disease in Porto Rico. Louisiana Planter **59**: 75-78. Ag. 4, 1917.

——— Diseases of vegetable and garden crops. Jour. Dept. Agr. Porto Rico **1**: 93-117. Ap. 1917.

Literature cited, p. 117.

Stevenson, John A. La nueva enfermedad de la caña. Porto Rico Insular Expt. Sta. Circ. **11**: 1-12. 1917.
Spanish ed.

Taubenhaus, Jacob Joseph. On a sudden outbreak of cotton rust in Texas. Science n. s. **46**: 267-269. S. 14, 1917.
Aecidium gossypii.

Taylor, Minnie W. Preliminary report on the vertical distribution of Fusarium in soils. Phytopathology **7**: 374-378. O. 1917.

Taylor, W. H. Black-spot of apples. Jour. Agr. [N. Zeal.] **15**: 98-100. Ag. 1917.
Venturia inequalis.

Tisdale, Wendell Holmes. Relation of temperature to the growth and infecting power of Fusarium lini. Phytopathology **7**: 356-360, pl. 11. O. 1917.

U. S. Department of Agriculture. Federal Horticultural Board. Service and regulatory announcements. August: 103-109. O. 2, 1917.

Van der Lek, H. A. A. Bijdrage tot de kennis van Rhizoctonia violacea. Meded. R. Hoog. Land- Tuin-en Boschbouwsch. Wageningen **12**: 49-112, 9 pl. 1917.
In Dutch and French.
Literatuur, p. 111-112.

Vermorel, Victor, and **Dantony, E.** Notes expérimentales sur l' efficacité des bouillies bordelaises, acides, neutres el alcalines 1915-1916. 28 p. Villefranche, Montpellier, 1917.
At head of title: Résumé des travaux de la station viticole et de pathologie végétale de Villefranche (Rhône).

Weaver, John Ernest. The effects of certain rusts upon the transpiration of their hosts. Minn. Bot. Studies **4**: 379-406, 9 fig., pl. 41-42. S. 1916.
Literature cited, p. 406.

Weimer, James LeRoy. Three cedar rust fungi, their life histories and the diseases they produce. New York Cornell Agr. Expt. Sta. Bul. 390: 505-549, fig. 136-157. 1917.
Literature cited, p. 548-549.

Weir, James Robert. Notes on wood-destroying fungi which grow on both coniferous and deciduous trees. II. Phytopathology **7**: 379: 380. O. 1917.

Wester, Peter Johnson. Additional observations on the citrus fruits in the Philippines. Philippine Agr. Rev. **10**: 104-115, pl. 2-8. 1917.
Table showing the degree of citrus canker affection in the citrus collection at the Lamao experiment station, p. 110-115.

[PHYTOPATHOLOGY for December, 1917 (**7**: 399-458), was issued December 3, 1917.]